Royal Commission
on Canada's Economic Prospects

The Commercial Fisheries of Canada

by The Department of Fisheries of Canada
and The Fisheries Research Board

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THE COMMERCIAL FISHERIES OF CANADA

Prepared by

THE DEPARTMENT OF FISHERIES OF CANADA

and

THE FISHERIES RESEARCH BOARD

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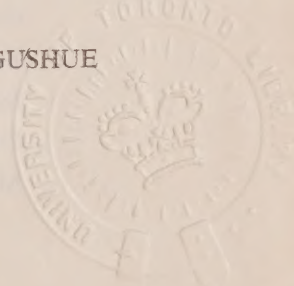

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NOTE

With reference to the table on page 18, *infra,* an upward revision of the projected stocks of Chum and Pink salmon is considered necessary as a result of certain developments since the preparation of the original estimates at the beginning of 1956.

Recent intensive investigation, connected with establishing a case for abstention by Japan under INPFC (see page 19), has produced evidence that the present stocks of these species are at a depressed level capable of being raised substantially by appropriate control of exploitation.

Agreement between Canada and the United States to prohibit offshore net fishing has made possible separate regulation of the fisheries for different salmon stocks, as required to meet their varying needs for protection.

The threat to the important Pink salmon of the Fraser river, latent in the international competition for the catch (see page 21), has been averted by the U.S.-Canadian agreement to bring these stocks under the control of the Commission regulating the Sockeye salmon fishery of the same river.

Finally, prospects for augmenting the stocks of the species mentioned through positive measures of fish culture appear to be improving.

The prospective stocks of Chum and Pink salmon in 1980, therefore, are now set at 300 million lb. and 230 million lb., respectively.

1

INTRODUCTION, HISTORICAL REVIEW[1]

1500-1900

DISCOVERY of the unusually rich codfish resource of the northwest Atlantic led to a rapid expansion of a fishing industry in this region from the beginning of the 16th century, to supply (a) the requirements of Mediterranean countries, where storable protein foods were normally scarce, and (b) the requirements of navies and of other shipping interests for compact foodstuffs (like dried fish) on long voyages.

From the first, the industry was an international one, with expeditions from England, France, Spain and Portugal participating. The English fishery—based on West Country and, from the early 17th century, New England ports—achieved dominance at an early stage, however, especially in the waters around Newfoundland. French operations were diverted to the offshore banks and the more remote areas in the Gulf of St. Lawrence. Aggressive English activity, together with the high domestic production costs following on the import of New World treasure, also resulted in the elimination of Spain from the fishery.

> . . . England was able, in part because of her relatively shorter distance from Newfoundland and in part because of the nature of fish as a foodstuff, to secure a strong and continuous hold on a product by which she obtained a share of Spanish specie and the products of the Mediterranean. Cod from Newfoundland was the lever by which was wrested her share of the riches of the New World from Spain.[2]

The routing of the product of the Newfoundland fisheries through England to the Mediterranean markets was gradually replaced by direct export to the Continent. Fishing ships proceeded to Newfoundland early in the spring, carried on the fishery during the summer months and took the product to markets in Europe. They were thus faced with the problem of transporting large numbers of men to Newfoundland for the fishery, thence to Europe and back again to the West Country. Colonizers, represented by the London & Bristol Company (1610), proposed, therefore, to establish

[1] Footnotes may be found in Appendix E.

a settlement which would enable men to stay over the winter, carry on a resident fishery and provide cargoes for ships in the European carrying trade. This and similar moves, however, were defeated by West Country fishing interests.

The growth of permanent settlements in Newfoundland was also discouraged by the difficulties encountered in agricultural development designed to supply food for winter residents. Population, therefore, migrated to New England. With the advantages of settlement, and the development of agriculture, lumbering and shipping, New England assumed increasing importance as a base for the fisheries, especially after the Treaty of Utrecht (1713) when the French withdrew from Nova Scotia. New England's expansion toward the middle of the century led to the capture of Louisbourg and the downfall of the French régime. This was followed by a movement of population from New England to Nova Scotia and the development of trade with Europe through Newfoundland. This trade, supported by the growth of the mainland economy, resulted in the founding of settlements on the island. Settlement in Newfoundland increased during the period of the Napoleonic wars and the prosecution of the fisheries by expeditions from the old country was abandoned.

The successful operation of the fleets engaged in the traditional Atlantic Coast fisheries required access to shore facilities for bait and other supplies and for curing the catch. This requirement was for long a source of conflict among the countries participating in these fisheries, more particularly between the English colonies on the one hand and France and the United States on the other. By the Treaty of Versailles (1783), France retained St. Pierre and Miquelon but lost some fishing rights on the coast of Newfoundland. Subsidization, designed to re-establish the French fishery, encouraged expansion of operations on the offshore grounds (using the trawl-line or bultow) after 1840 and resulted in intensified competition in the export trade. This development was resisted by Newfoundland, especially with the emergence of responsible government there (1854), by means, for example, of restrictive bait legislation. To resolve this conflict of interests, the United Kingdom was induced to recognize Newfoundland's right to exercise control over the use of its natural resources, later to cede jurisdiction over the "French Shore" to the colonial government and finally, following the turn of the century, to purchase the principal French rights in Newfoundland territory.

The Versailles Treaty also imposed restrictions on United States (New England) fishing operations, and the convention of 1818 fixed the rights of American fishermen in the territorial waters of the English colonies as being "for the purpose of shelter and of repairing damages, of purchasing wood and obtaining water and for no other purpose whatsoever." The enforcement of these terms, instigated by Nova Scotian trading interests as a check on smuggling activities, led to numerous clashes. Conflict was temporarily

eliminated by the Reciprocity Treaty (1854-66) and again by the Treaty of Washington (1873-85). On the termination of the last-mentioned treaty, Newfoundland tried to negotiate reciprocal arrangements of its own with the United States. Failure in this was followed by renewed attacks on the presence of Americans in the territorial fisheries of Newfoundland and later by submission of the problem to the Hague tribunal, which reported in favour of Newfoundland's position. In 1888, a *modus vivendi* was negotiated under which, on payment of a licence fee, American fishermen were permitted to use Canadian and Newfoundland harbours for the purchase of supplies, trans-shipment of catches and shipping of crews. Intended as a temporary arrangement, pending conclusion of a satisfactory treaty, it remained in effect until 1918.[3]

In the meantime, the major source of conflict had disappeared with the passing of the New England salted fish industry. Throughout the period under review, however, salted and dried fish—principally cod, with herring and mackerel of equal importance in certain districts—remained the staple product of the industry in Canada and Newfoundland. The trade with the West Indies declined following the abolition of slavery there (1833) but the American Civil War led to renewed expansion, including operations on the offshore grounds.[4] The production of dried salted cod in the Atlantic Coast fisheries reached a peak in the 1880's. Decline set in thereafter as the result of a gradual accumulation of factors, including a) the decay of numerous ports with the disappearance of wooden shipping, b) a weakening of the market in countries dependent on cane-sugar production, with the development of beet sugar, c) competition from other food products and d) the appearance of outlets for fresh fish. By the close of the century lobstering had begun to rival the traditional cod fishery.

The early history of the fishing industry in Canadian Pacific waters was also dominated by a single species, the sockeye salmon. The culture of the native population had been largely based on salmon and the annual spawning migrations of this group of species to the rivers of the Pacific coast had brought about a concentration of that population at strategic locations there. These locations naturally served as bases for the fur trade when it expanded to the coast at the beginning of the 19th century. At points on the Fraser River and elsewhere, the Hudson's Bay Company established a position from which it could utilize the United States traffic across the Pacific. Exports of salt-cured salmon to the Hawaiian Islands and the continent of Asia began in 1835.

The influx of population to British Columbia following the gold rush in the late 1850's created a substantial local market for salmon. With the decline of the gold fields, attention was directed to the exploitation of other resources, particularly the forests and the fisheries. Expansion of the fishing industry, however, awaited the development of markets and processing techniques. Commercial canning of salmon began on the Fraser

River about 1870. This branch of the industry, pioneered by individuals and firms with experience acquired in lobster canning on the Atlantic Coast, expanded rapidly. A cannery was built on the Skeena River five years later.

Completion of the transcontinental railway, by providing access to the markets of eastern Canada and the United States, gave new impetus to expansion. Cold storage plants for handling salmon were established on the Fraser River in 1887. Because of advantages in freight rates, American lines carried most of the traffic until 1892, when specially designed refrigerator cars were made available to move fish over the Canadian Pacific railway system.

The new outlet for frozen fish provided a basis for development of the halibut fishery, until this time largely restricted to the service of local requirements. By the end of the century a year-round fishery had been established and was expanding to the offshore grounds. The bait requirements of this fishery in turn enabled the herring fishery to develop on a considerable scale in British Columbia waters.

From the completion of the railways until the turn of the century, the fishing industry on the Canadian Pacific Coast continued to be characterized by small units centred mainly on the Fraser River estuary. Although industrialization had already caused a rise in labour costs and, consequently, some mechanization of canning operations, capitalization was generally on a small scale. The depression of the 1890's resulted in numerous bankruptcies—followed by a number of business amalgamations.

The fishery resources of the lakes and rivers in the interior of Canada, particularly those extending along the edge of the Canadian Shield between the St. Lawrence and Mackenzie Rivers and including the Great Lakes, the lakes of the Prairie Provinces and Great Slave Lake, were utilized to some extent by the native population from the earliest times. Later they came to be exploited by Europeans in support of fur trade development and colonization. With the advance of settlement and the growth of urbanization some of these resources were depleted. Others, as in the case of many sea fishery resources, remained virtually untapped during the early period.

1900-1955

About the beginning of the present century, important changes began to take place in the Canadian fisheries. The gasoline engine came into use in the small-boat sector of the primary industry in the first decade of the century and purse-seining (for salmon and herring) was introduced on the Pacific Coast. The use of draggers, or otter-trawlers, was introduced in Atlantic coast waters in 1908. The latter innovation met powerful opposition, particularly from inshore line-fishermen who saw in it a threat to their livelihood. As a highly efficient instrument of production, beyond

their means to acquire, the dragger seemed to undermine the stability of their sales outlets. In response to this opposition, dragging operations were placed under restrictions that, with greater or less severity, persisted for many years. The purpose appears to have been to retain the largest possible labour force in the fishing industry. The effect, however, was to retard the growth of productivity and, consequently, of individual incomes in this industry. The ultimate result, therefore, would be the reverse of that intended. Misguided policy of this nature is a common affliction of the fishing industry.[5]

As already mentioned, early progress was made in the mechanization of the secondary industry on the Pacific Coast. The *iron chink,* a machine for heading and gutting fish, was introduced into canning plants in 1906 and development in this field has been more or less continuous since then. It should be explained, however, that the application of mechanical processes was facilitated by factors such as the uniformity in size of salmon — in contrast with cod, for example, the principal raw material available to the industry on the Atlantic Coast.

Mechanization gave impetus to further amalgamation and the growth of relatively large business organization in the Pacific Coast fisheries. This development was associated with a) a shift toward utilization of species other than the sockeye and a related movement northward, particularly after the decline of the sockeye runs to the Fraser River (1913), and b) a shift to the marketing of salmon and other species in fresh and frozen forms. The northward movement of the industry was assisted by the completion of a transcontinental railway to Prince Rupert (1915) and the construction of cold storage facilities there.

By this time the development of transportation and of refrigerated fish handling facilities, as well as the growth of urban centres in Canada, had begun to create an outlet for fresh and frozen fish products. Diversion to these was reflected in the pattern of production. It affected especially the output of salted fish. Establishment of a refrigerated railway freight service for fish products from both coasts to points in central Canada, including the Prairie Provinces, was supported by a federal government subsidy from 1909 to 1919. Substantial expansion in the domestic market for these products has been attributed to this programme.

During World War I, because of the drop in European supplies, the production of dried salted codfish was expanded in the Atlantic Coast area, particularly in Newfoundland. After the war, European production was restored and expanded and the cure improved. The Mediterranean markets for Newfoundland's exports narrowed and, in an effort to maintain the level of production achieved in wartime, the Newfoundland trade sought outlets in the West Indies—hitherto largely a preserve of Nova Scotian exporters. In the struggle that ensued, beginning about 1926, the price of fish was forced down throughout the whole Atlantic Coast region. It

fell on the average by more than 50% between that date and the end of the depression (1939). Because of the rather rigid structure of the industry and the character of its social milieu, the slump in the cod fishery was transmitted to other fisheries, e.g. those for herring and lobster.

As a result, the income of fishermen in Newfoundland was reduced to an extremely low level. The effects on the island's economy led to the collapse of responsible government in 1933. The position of fishermen in the Maritimes and Quebec was slightly better, although privation was widespread in this region as well. Limited alternatives to dependence on the traditional salted fish trade were available to the industry on the mainland: inshore fishermen could shift to some extent to the production of certain cures acceptable in the United States market and the Nova Scotian salt-banking fleet could expand winter fishing operations (for the fresh fish markets) on the offshore grounds.

Expansion of the fresh (chilled and frozen) fish trade was facilitated by two innovations of the early 1920's, both originating in New England: filleting (at source of production) and quick-freezing. The first of these innovations resulted in economies for the industry through the reduction of transportation costs, per unit of edible product, and through the utilization of waste material for by-products. It also resulted in a revolution in the packaging and handling of fish products, making possible brand differentiation and the creation of other display values. The second innovation permitted greater standardization of quality and, by adding greatly to the carrying properties of perishable foodstuffs through time and space, it made possible avoiding or at least minimizing fluctuations in supply, on the one hand, and the extension of markets geographically, on the other. Together, in short, these two innovations enabled the products of the fisheries to take their place among those of other modern food industries.

The Canadian Atlantic fishing industry lagged in development on the basis of the innovations just described. This may be attributed to several causes: a) the lack of a mass market close at hand, b) the conservatism of the business community involved and the scarcity of venture capital for investment in the industry, and c) political opposition to modernization—draggers were gradually eliminated from the fishing fleets after 1929.

Nevertheless, especially in Nova Scotia, some progress was made. In that province, the development of the fresh fish trade in the inter-war period fell into two phases. In the first, up to about 1930, it depended almost solely on expansion of sales in central Canada; in the second, aided by favourable rates on the Canadian railways, an important market was opened up in the middle west of the United States. In the latter phase, growth was more rapid, despite the adverse U.S. tariff between 1930 and

1936. Development throughout the period was restricted to the trade in chilled fresh fillets of groundfish, live lobster and a few other items. Distributive facilities were still inadequate to encourage the growth of a trade in frozen fish products.

This development represented more than a shift from fish curing to processing in other forms. A substantial shift from the cod fishery to fishing for other groundfish species, particularly haddock, was involved. Because mechanized processing methods require plants of comparatively large size and a concentration of fishing activities—to ensure some stability of supply—a movement from smaller to larger fishing ports, notably Halifax and Lunenburg, was also involved.

Progress was more rapid on the Pacific Coast. The trend toward amalgamation of plant and business organization, noticed earlier, was intensified in the interwar period and was accompanied by advances in fleet modernization. This trend was motivated by such factors as the high cost of labour in the region, as compared with the Atlantic Coast—associated with restrictions on the use of Oriental labour—and the consequent need for large-scale investment of capital. It was facilitated by the relatively high-priced products of the industry, e.g., canned salmon and frozen halibut, capable of bearing shipping charges over long distances. Although the industry was thus able to secure a broadly based market, it was very largely an export market and a highly competitive one.

During World War II, the demand for fishery products for both feeding and industrial purposes was vastly strengthened. The salted fish trade of the Atlantic Coast was given a new lease on life and a filleting and freezing industry was established in Newfoundland. A relaxation of restrictions on the use of draggers initiated a trend toward modernization of the fishing fleets throughout the Atlantic provinces. Unionization and the co-operative movement gained ground among fishermen, especially on the Pacific Coast. A national federation of fish trade associations, the Fisheries Council of Canada, was formed in 1945.

In the postwar period, a number of economic influences have been operating strongly in the direction of further development in the fishing industry. Continued buoyancy in the national economy generally has sustained a favourable outlook for the demand for fishery products. Prices for most of these products have been high relative to other wholesale prices.[6] A high level of demand for labour throughout the economy has drained off the pools of low-cost labour previously available for various occupations in the fisheries, e.g. to man the dory schooners fishing on the banks. Withdrawal of the surplus labour supply has tended to encourage the substitution of capital for labour, i.e. the mechanization of processes. Progress in the technology of refrigeration, curing, canning and other

operations involved in the catching, handling and processing of fish has opened up profitable opportunities for such substitution.

In the development fostered by these conditions, the industry on the Pacific Coast has again taken the lead. The investment per man, for example, in the primary fishing operations of that region has been doubled in the ten years following the war—representing an increase in the size of fishing craft, in power equipment and in equipment with electronic navigational and fish-locating devices. There has been a concomitant consolidation, and further mechanization, of the fish processing industry. Moreover, as a result of the greater mobility of fishing craft, the fishing population has tended to concentrate, particularly at Vancouver.

In this period, however, the fisheries in other regions have begun to close the gap formerly separating them from those of the Pacific Coast. A processing (filleting) industry has developed in the inland fisheries and commercial operations have been extended to Great Slave Lake, for example. On the Atlantic Coast, the great fleet of dory schooners has virtually disappeared and has been replaced by a steadily growing fleet of draggers, long-liners and other modern craft. Moreover, with greater diversification of industry generally in the Atlantic provinces, the dependence of the coastal population on fishing has been reduced throughout this region.

Opportunities for profitable investment in the secondary industry have been particularly inviting, perhaps, in the branch utilizing some of the Atlantic groundfish resources. Continuous, if somewhat uneven, expansion in the market for frozen foods in North America[7], as well as improvements in filleting and freezing equipment, have induced an almost spectacular growth of modern fish-processing capacity in this branch of the industry. Complete data on the growth of investment in fish processing operations during the recent past are not available, but the number of new plants and the decline in numbers employed—with increased output—indicate that the growth has been considerable.

On the Pacific Coast, in the inland region, and to some extent on the Atlantic Coast, the developments described have been promoted by the unusually auspicious environment of the industry over the past decade. Particularly in the Atlantic Coast area, however, intervention by government has played a significant role. This is discussed elsewhere.[8] It has affected principally the primary industry and has been accompanied by still further relaxation of control over expansion of the deep-sea dragger fleet. Altogether, the increase in investment per man in the fisheries of the Atlantic Coast has been high for that region though still behind that of the Pacific Coast in the same period.

Nevertheless, spots of stagnation—some of them fairly large—remain, especially in certain districts on the Atlantic Coast and also in the inland

region. The most seriously retarded branch of the industry is probably the so-called inshore salted cod fishery of Newfoundland. The problem of this fishery is urgent because the export trade in the product is approaching a crisis. Its outmoded character no longer supports competition in quality and market service with its rivals. Loss of this trade would further reduce the diversity of the Atlantic Coast fishing industry generally and of the Newfoundland economy in particular. The first requirement is to shift the processing operation from the small-boat crews, using manual methods, to centralized curing stations equipped with mechanical drying and other modern devices—a development already well established in fish curing elsewhere in this country. This would involve investment in plant and equipment on a scale comparable with that needed to finance similar productive capacity in other sections of the fish processing industry.

2

THE RESOURCES

THE FISHERY resources available to industry in Canada are remarkably extensive and abundant. The Atlantic coastline from the entrance to the Bay of Fundy to Hudson Strait and including Newfoundland and other islands is about 12,000 miles long. The Pacific Coast is over 7,000 miles long and is exceptionally well sheltered. Large tracts of the continental shelf in both areas lie within the 250 fathom depth contour where the richest ocean fishing grounds are usually found. In these coastal areas, the sea floor, the chemical constituents of the water and conditions of temperature, light and ocean current combine to provide a suitable environment for a variety of fish species. A large number of species find similarly suitable conditions in the inland waters of Canada, estimated to be some 260,000 square miles in extent.

Some of these stocks of fish are noted for their great quantity, others for their exceptionally high quality. Because of the large quantity of certain stocks in close proximity to the coasts, catching costs are low enough to permit the Canadian fishing industry to compete effectively for the low-price mass food market with such products as fillets of groundfish. On the other hand, species such as lobster and salmon possess sufficient excellence of quality to permit effective competition in the quasi-luxury food markets where prices are often relatively high.

Since particular species require more or less unique environmental conditions, many are confined to distinctive locations to a marked degree. Lobsters and oysters, for example, are bottom dwelling and are commonly located in relatively shallow water fairly close to shore. In the case of herring, evidence indicates that they live chiefly in offshore waters but move inshore, where they are usually caught, at spawning time. The cod commonly stays close to the bottom on the offshore banks,[1] except for periodic movements in search of food or in response to changes of water temperature. On the other hand, salmon are ordinarily caught in the vicinity of river estuaries when returning from the sea to the coastal streams for spawning. The wholly freshwater species are found mainly in the inland lakes, although a few make their permanent home in rivers.

Most of the important freshwater fish resources, e.g. whitefish, pickerel and lake trout, are found in the larger inland lakes. In the case of rivers and small lakes in the heavily populated and industrialized areas, the competition of other water uses—for navigation, industry and recreation—often prevents effective utilization of such waters for either commercial or sport fishing. The inland waters that produce the bulk of the commercial catch are located either some distance from population centres, e.g. the Great Slave Lake, or are so great in extent that the area affected by industrial pollution and the like is small in relation to the total area, e.g. Lake Superior.

Of the numerous species of fish found in the nearby sea and inland waters, more than 150 kinds have commercial significance.[2] Some of these, as well as a number of other species, are also utilized by the rapidly growing sport fishery. To examine each commercial species separately may obscure their significance. This is because many species complement one another through being caught with the same gear or being processed and marketed in the same form. For these reasons, the appropriate approach to the assessment of Canada's fishery resources would seem to be to group them according to those species for which catching, and often processing, techniques are broadly similar. It is thus possible to identify fairly clearly the half dozen or so major groups upon which the Canadian fishing industry is based. Briefly, these would include (1) the groundfish group, excluding halibut, with special reference to Atlantic groundfish, (2) halibut, with special reference to Pacific halibut, (3) the Pacific salmon group, (4) the herring of both coasts, (5) Atlantic lobster and (6) the group of freshwater species.[3] There are also a number of minor groups of lesser commercial value but often of considerable supplementary importance.

In what follows, estimates[4] of the quantities of the various stocks of fish available in Canadian waters[5] are tabulated, together with statistics of the current average annual catch taken from these stocks by the fishing industries of Canada and other countries. The tables also include estimates of the quantities likely to be available in 1980.[6] In some instances an increase is forecast, in others a decrease. These changes may be due, in part, to climatic factors. For example, the trend toward higher temperatures in the waters of the northwest Atlantic, evident for a number of years, is predicted by oceanographers to reverse about 1960, creating an environment more favourable than the present for cold water species like cod and less so for warm water ones like swordfish.

Environmental changes may also be brought about by human agency. Historically, such changes generally have been deleterious to fish stocks: the obstruction of salmon migration in the Fraser River, described later, is an instance. Man may also act to build up stocks, however, especially in the case of anadromous species, e.g. by providing fishways to surmount

natural obstacles in streams, improving natural spawning facilities, artificial propagation and the control of predation. Direct aids of this kind probably will play a more important role in the Canadian fisheries as time goes by.

The most important factor affecting the future size of fish stocks is considered to be the activity of the fishing industry itself. An unexploited stock tends to become so dense that growth is slow and natural mortality is high—losses are balanced by reproduction but there is no net surplus. A fishery, by reducing the density of the stock, may create the conditions necessary to produce a surplus harvestable annually. Removal of the older and larger fish, a process known as "fishing up the accumulated stock," increases the rate of reproduction or the rate of growth or both. The process may be carried too far, however, eventually causing the production of an annual surplus to decline.[7] In purely biological terms, the optimum level or intensity of fishing is the one compatible with a maximum sustained yield. Two basic principles follow: (1) if a stock is being utilized below its potential yield because of underfishing, more intensive fishing will raise the level of sustained yield and reduce the size of the stock (at least the spawning stock) at the same time; (2) if a stock is being utilized below its potential yield because of overfishing, less intensive fishing will raise both the level of sustained yield and the size of the stock.[8] On the basis of such considerations, biologists make the somewhat paradoxical prediction that in many Canadian fisheries a larger catch may in the future be obtained from a smaller fish stock.

In a later chapter an estimate will be made of the catch requirements of the fishing industry in Canada by 1980, based on the anticipated growth of the markets which it serves. The extent to which these demands on available stocks will in fact be realized depends on a number of factors besides the impact of intensified fishing on the ecological balance of the fish populations. Fishing operations involve inputs of capital and labour, i.e. costs of production. The optimum intensity of fishing is that which maximizes the difference between costs and returns, and this normally is somewhat less than the level of intensity that maximizes the yield in physical terms.[9] This optimum is affected by the price of fish and by the price of production factors, including equipment and supplies and fishermen's "opportunity cost." It tends to be lower, the greater the reduction in stock that results from fishing; it would be lower in the case of the fishery for redfish than in that of the cod fishery, for example. Because of the common-property character of fishery resources, however, the equilibrium of a fishery at optimum intensity is unstable. Fishing operations may be pursued beyond this point, resulting in the widespread problem of over-exploitation.[10]

Groundfish[11]

Species	Present Stock million lb.	PRESENT UTILIZATION Canada million lb.	Others million lb.	Total million lb.	Rate %	Probable Catch Trend	Prospective Stock, 1980 million lb.
Atlantic:							
Cod	6,800	710	400	1,110	16.3	increase	6,500
Haddock	480	112	90	202	42.1	decrease	340
Pollock	200	32	7	39	19.5	increase	160
Hakes[12]	300	30	1	31	10.3	increase	260
Cusk	30	2	[13]	2	6.7	increase	30
Redfish	2,200	38	124	162	7.4	increase	1,350
Wolffishes[14]	110	6	1	7	6.4	increase	90
Flatfishes[15]	500	65	6	71	14.2	increase	400
Gr.-land Hal.	20	1	—	1	5.0	no change	20
Skates[16]	70	[13]	[13]	[13]	—	increase	70
Dogfish	[17]	—	—	—	—	no change	[17]
Subtotal	10,710	996	629	1,625			9,220
Pacific:							
Grey Cod	53	5	6	11	20.8	increase	45
Lingcod	120	4	2	6	5.0	increase	100
Rockfishes[18]	30	1	8	9	30.0	no change	20
Flatfishes[19]	135	9	6	15	11.1	increase	131
Blackcod	14	1	3	4	28.6	no change	20
Dogfish	600	1	1	2	0.3	no change	800
Others[20]	60	3	2	5	—	increase	50
Subtotal	1,012	24	28	52			1,166
Total	11,722	1,020	657	1,677			10,786

The group of groundfish or demersal[21] fish is dominated by Atlantic species. Among these, cod, haddock, pollock, hake, redfish and the subgroup of small flatfishes are the most important commercially. Altogether, more than one-quarter of Canada's total output of fishery products is derived from Atlantic groundfish. The principal products are frozen fillets and cured fish (chiefly dried-salted cod). The species are caught in the Gulf of St. Lawrence, on the banks east of Nova Scotia, the Grand Bank and northward to Hamilton Inlet bank. They are caught by small and large craft, using principally line gear and drag-nets, i.e. otter-trawl and Danish seine — the type of gear being determined by the species involved (line gear is unsuitable for those with small mouths) and by the nature of the fishing ground (some are too rough for the use of drag-nets). Along the east coast of Newfoundland and at scattered locations elsewhere, where

inshore runs of certain species (chiefly cod) occur, trap nets are widely used for their capture.

Cod makes up about 65% of known Atlantic groundfish resources, and almost 60% of all the groundfish resources of Canada. Stocks of the species are found throughout the coastal area from Cape Hatteras to Baffin Island. Many of these stocks, because of their remoteness, are exploited only to a limited extent if at all by Canadian fishermen. There is no evidence that the stocks on the nearby and richer fishing grounds—about half of all the stocks available—upon which, for the most part, operations have been concentrated, are approaching exhaustion or even serious depletion. Moreover, the density of these stocks may be increased by the lower water temperatures predicted for the near future On the other hand, an increase in the ratio of cod prices to fishing costs could lead to substantial intensification of the fishery. While this might result in the extension of operations to more remote and less prolific grounds, it need not, with proper management policy, cause over-exploitation of those upon which the fishery is now based.

Haddock, next in importance at the present time to cod, are common along the Atlantic Coast from Cape Cod to the southern part of the Grand Bank. Stocks in the Gulf of St. Lawrence are relatively small. The species is found usually in waters warmer than cod prefer. Most of the catch is taken with drag-nets. In recent years, the introduction of mechanical filleting equipment has enabled processors to utilize younger and smaller haddock. It is doubtful, however, that the resulting increase in the annual catch can be sustained. The haddock stocks are considered to be heavily exploited in the current period. This is expected to lead eventually to a substantial reduction in total stocks and, probably, in the catch.

Redfish[22], ranking third in importance among the Atlantic groundfish species, occur from New Jersey to Labrador but are most abundant in the Gulf of Maine and off the coast of Nova Scotia. The stocks are found in deep, cold water and are taken exclusively with drag-net. The species is very slow growing and there is little or no movement from one stock or population group to another. The fishery for redfish is of comparatively recent origin and, up to the present in most areas, has utilized largely the accumulated stock of older fish (a large proportion of the fish taken are more than 20 years old). A number of the more remote northern grounds remain unexploited so far. The separate redfish stocks, once depleted, recover rather slowly, and total stocks are expected to suffer a reduction of nearly 40% over the next 25 years. There is some possibility, however, that new stocks may be found to compensate in part for the reduction in known supplies.

The sub-group of small flatfishes includes the American Plaice, Witch,[23] Winter Flounder and Yellowtail Flounder. Plaice range over a wide area from Long Island to the Arctic; the other species are more

localized. With the exception of plaice, which may be taken with line gear, all are caught with otter-trawl and Danish seine. Total stocks, although likely to decline somewhat by 1980, are expected to be capable of sustaining a considerable increase in the annual catch.

Pollock, although they range as far north as St. Pierre Bank, are taken mainly about the mouth of the Bay of Fundy. They are taken usually with line gear. Cooler temperatures, as anticipated for the near future, may reduce the range of the species and the total stock. Nevertheless, stocks are considered to be capable of sustaining substantially increased utilization.

Hake, including White Hake, Squirrel Hake and Silver Hake,[24] are found throughout much the same region as pollock. Some of the species occur also in the Gulf of St. Lawrence. Silver hake, a southern species and at present constituting about a third of the total stocks, may retreat from this region with the return of lower water temperatures. Hake soften quickly, even when iced, which makes their processing difficult — so that large quantities, caught incidentally in fishing operations for other species, are discarded at sea A stronger market for the products of the groundfish fisheries, such as may be expected gradually to develop, could thus lead to increased utilization of the hake stocks.

The wolffishes[25] include two species, the Common or Striped and the Spotted Wolffish. The former occurs more frequently in the southern part of the Atlantic Coast area and the latter in the northern part. They are usually caught incidentally in line-fishing or dragging for other groundfish species, particularly codfish. The density of the stocks is quite low, relative to those of codfish, and, as in the case of halibut, a substantial increase in the ratio of their price to that of cod is prerequisite to intensification of the fishery.

Cusk are most common in the southern part of the Atlantic Coast area. They are usually found on the rougher grounds, are seldom concentrated and are caught incidentally with other species. Like the wolffishes, the species is of excellent quality as a food fish.

The Greenland Halibut[26] is a northern species caught, with line gear, mainly along the northeast coast of Newfoundland. Traditionally, this fish has been salt-cured for the market and the future prospects of the fishery would appear to depend on the possibility of its preparation in alternative forms.

There are substantial stocks of Skates[27] and Dogfish throughout the Atlantic Coast area. Catches of the former are incidental and negligible, however, while the latter species is not exploited at all commercially. Both species may be utilized for food or for reduction[28] purposes, but the prospect of either development during the next 25 years depends on changes in technology and price structure not foreseeable at present.

The foregoing indicates that utilization of the Atlantic groundfish stocks is capable of very considerable expansion, especially in the case of codfish. At the same time, particularly in the case of redfish, this expansion will result in a substantial reduction in total stocks. In recent years, the prospect of increasing intensity of operations in these fisheries has begun to concern authorities in the several countries sending fleets to the northwest Atlantic fishing grounds.

Accordingly, the International Convention for the Northwest Atlantic Fisheries was signed in 1949 and has since been ratified by the ten signatory governments: Canada, Denmark, France, Iceland, Italy, Norway, Portugal, Spain, the United Kingdom and the United States. Others may adhere in the future. The Convention provides for the establishment of a commission on which all contracting countries are represented, and for separate panels with jurisdiction over defined sub-areas on which countries with particular interests in such sub-areas have representation. The Commission's primary function is investigational; it has no regulatory powers but may recommend joint action by member governments to regulate fishing operations in any part of the convention area. Recommendations relating to mesh size in drag-nets and the use of "savings gear" have already been made and acted upon.

The known groundfish resources in Pacific Coast waters evidently amount to less than 10% of those available in the Atlantic Coast area. The products of the Grey Cod, Lingcod, rockfish and flatfish[29] fisheries supplement those derived from similar species caught in Atlantic waters. Blackcod, however, is a semi-luxury fish. The bulk of the Pacific groundfish catch is taken with drag-net. Almost the entire catch of blackcod, however, the greater part of the lingcod catch, and a part of the rockfish catch are taken with line gear. Most of the blackcod catch is taken by vessels of the halibut fleet during the off-season. The stocks of grey cod, lingcod and two or three of the flatfish species are considered capable of supporting more intensive utilization than at present but, since the demersal fishing grounds of the Pacific Coast are relatively narrow in extent, the outlook for the supply of groundfish products as a whole is not substantially altered.[30]

Halibut

	Present Stock	PRESENT UTILIZATION				Probable Catch Trend	Prospective Stock, 1980
		Canada	Others	Total	Rate		
	million lb.	million lb.	million lb.	million lb.	%		million lb.
Pacific	700	24	38	62	8.9	increase	600
Atlantic . . .	60	6	[31]	6	10.0	no change	60
Totals	760	30	38	68			660

The Pacific halibut stocks are found on the continental shelf from Juan de Fuca Strait to the Aleutian Islands. Two-thirds of the present Canadian catch is taken in the southern part of this area. Line gear mainly is used, with some fish also taken by trolling.[82] Partly for that reason, fishing operations are largely restricted to the grounds of highest concentration. These are but a small part of the total area and temporary declines in abundance on such grounds tend to be replenished from the remainder of the population dispersed comparatively sparsely over the wider area. About 90% of the catch is marketed in the dressed frozen form.

Depletion of the halibut stocks was feared as early as 1910, and in 1922 a Royal Commission recommended measures for their conservation. As a result, a treaty was negotiated with the United States in 1924[83] for joint regulation of the halibut fishery. The original treaty was replaced in 1937 by the North Pacific Fisheries Convention and in 1953 by the Northern Pacific Halibut Convention. Under these arrangements, an international commission was created with power to study the resource and control its exploitation subject to the approval of both governments. On the basis of analysis indicating increased fishing intensity as the causal factor in the observed decline in total catch and in productivity per unit of gear, an annual catch quota was imposed and, with some modification, it has been maintained in force up to the present time. In certain instances, also, areas were closed to permit the stocks to recover.

Subsequent study has shown that the original analysis may be inadequate to explain the recovery of the stocks during the past two decades. Evidently, factors such as higher water temperatures and a growth in recruitment resulting from the reduction in the density of the stock may have contributed to this recovery. These considerations would point to a decrease in total stocks beginning in the immediate future. On the same grounds, however, a moderate increase in exploitation is indicated as quite feasible and probably desirable.

The Pacific halibut fishery evidently continues to be beset with economic difficulties. Competition among fishermen each season on the nearer grounds, to obtain as large a share as possible of the fixed catch, has reduced the season from a year-round one to one of a few weeks' duration. As a result, the operations of the specialized halibut vessels, each of which represents a relatively large investment in this phase of the fisheries, may be seriously restricted.

Halibut occur in deep water throughout the Atlantic Coast area, the larger stocks being found in the southern part of that area. They are of minor importance compared with those of the Pacific area. The catch is taken with line gear and, to some extent, incidentally in dragging

operations. The intensity of the fishery appears to be related directly to the ratio of halibut prices to cod prices and no increase is foreseeable at present.

Salmon

Species	Present Stock	PRESENT UTILIZATION				Probable Catch Trend	Prospective Stock, 1980
		Canada	Others	Total	Rate		
	million lb.	million lb.	million lb.	million lb.	%		million lb.
Pacific:							
Sockeye:	84	41	16	57	67.8	increase	304
Fraser River	(42)	(17)	(16)	(33)	78.5	(increase)	(250)
Other districts	(42)	(24)	—	(24)	57.1	(increase)	(54)
Chum . . .	150	58	23	81	60.7	increase	150
Pink	116	45	13	58	50.0	increase	130
Coho	40	23	—	23	57.5	increase	40
Spring[34] . .	22	13	—	13	59.1	increase	20
Steelhead . .	5	1	—	1	20.0	increase	5
Subtotal	417	181	52	233			649
Atlantic:	10	4	—	4	40.0	increase	20
Totals	427	185	52	237			669

Pacific salmon comprise the most important group of species in the Canadian fisheries. The importance of the group lies not only in its present value as a renewable resource but in the prospect of an expanding domestic and export market for the products derived: canned and frozen salmon, etc. Special attributes of anadromous[35] species are their comparative ease of capture (in the course of the spawning runs) and the accessibility of their spawning and rearing habitat for man-made modification. The Pacific salmon fisheries thus present perhaps the outstanding opportunity for profitable expansion in the fishery segment of the Canadian economy.

The sockeye is the most highly valued of the Pacific salmon species, evidently because it retains its colour best when canned. Practically all races of sockeye are reared in lakes for one or two years from birth, so that a river's sockeye production depends in the first instance on the presence of suitable lake nurseries. The fish usually remain at sea[36] through two and a half or three and a half seasons, reaching maturity at four or five years of age. Adult sockeye move upstream in summer and early fall to spawn, generally in the tributaries and outlets of their lakes of origin. On this homing migration they are caught, with purse-seine, gillnet and trap,[37] in the approaches to the coastal rivers and in the estuaries.

The Fraser River formerly contained the largest sockeye stocks of any river in the world. The total productive lake area in this river system is about 960 square miles, more than twice the area of all the other sockeye lakes of British Columbia combined. At one time, the dominant stocks

occurred in the 1901 or "big year" line or cycle for nearly all lakes and the total stock and the catch in this line greatly exceeded those in the other three, so-called off year, lines. Since 1930, however, the newly dominant and incipiently dominant stocks in the different lakes have been distributed more evenly among the four years in each life cycle.

In 1913-14, rock slides at Hell's Gate in the Fraser River canyon,[38] although removed at once in large part, created a severe impediment to salmon migration in the river. In association with heavy exploitation in subsequent years, this reduced most of the sockeye stocks to a fraction of their former size. Action to rehabilitate the stocks was delayed for many years because of the failure of the governments concerned to reach agreement in this matter. Negotiations initiated by the Canadian government with the government of the United States in 1914 and 1919 and with the government of the State of Washington in 1922 were alike unsuccessful. Negotiations undertaken again in 1928 were finally successful in 1936, when the International Pacific Salmon Fisheries Convention was ratified.

Following a lengthy period of investigation by the Commission set up under this Convention, fishways were constructed at Hell's Gate in 1945-46 which facilitated passage at that point. More recently, other obstructions have been removed from the river and its tributaries. Concurrently, seasonal closures were imposed to ensure escapement of sufficient spawning stock, particularly of the early and mid-season upriver runs. It is considered that with these instruments, the sockeye runs to the Fraser River can be fully restored.[39] Further, it is estimated that, for most of the stocks, this can be accomplished in three generations, i.e. 12 years, and that the river's maximum yield can be attained well before 1980. A fivefold increase in the total stocks is thus forecast, which, it is thought, could be cropped at a rate of about 70% per year. Under arrangements as at present, Canadian fishermen would share half the crop.

Additional protection for the sockeye salmon and other species in Pacific waters will be obtained, it is hoped, through the International Convention for the High Seas Fisheries of the North Pacific Ocean. This treaty was concluded in 1952 by Canada, Japan and the United States and ratified the following year. It provides for a commission, representative of the three countries, with investigational and recommendatory powers only. The contracting parties have agreed to abstain if necessary from exploiting on the high seas any stocks of fish which are a) under scientific management, b) under legal regulation and c) already fully exploited by one or two of the parties.

While an increase in the use of Fraser River water by agriculture and industry poses a threat to the sockeye stocks, the most serious threat comes from power development. No techniques are available at present that would permit the co-existence of salmon and a high dam, or a series of low dams,

without serious mortality of the fish. A way to transport the young fish down stream may be devised — it may ultimately be a matter of cost — but the transportation of the adult fish upstream, in spite of the progress that has been made, presents a more formidable problem. The provision of by-pass facilities for nearly 50 million fish (including 20 million sockeye) per season —the number that would need to be provided for in the river at full production—might involve astronomical costs. Moreover, it would be unsuccessful if it delayed the fish beyond the stage of their sexual maturity—or beyond the period of suitable water temperatures. Power development, therefore, could reduce the salmon stocks to those nurtured in the areas near sea level where such development is unlikely. In the case of Fraser River sockeye, these stocks would be negligible.

Power development also threatens the sockeye stocks of the Skeena River, the second most important salmon stream on the Canadian Pacific Coast—its present sockeye stocks are a third of all those outside the Fraser River system — and the only other one for which a substantial increase in sockeye production, an increase of almost 80%, is predicted. This prediction, which would permit the present catch to be doubled, is based on advanced techniques of fish culture and management. It is not known, however, whether the economics of these techniques in application on the Skeena or elsewhere would justify the implied expectations.

Like the sockeye, chum salmon mature at three to five years and, like the former species too, they migrate to sea over very great distances from the home base. Unlike the sockeye, however, the young of the chum salmon are reared in short coastal streams and they spend but a short time in fresh water before migrating to sea. The greater part of the Canadian catch is obtained in the central coast and Johnston Strait districts. A little over half the total is taken with purse-seines and the remainder with gill-nets. Although canning is the chief form of utilization, a substantial proportion of the catch is also disposed of in the fresh, chilled and frozen forms.

Since chums make little use of the upper reaches of rivers, the stocks of this species would not be seriously affected by power development on the watersheds of the Pacific Coast. The spread of industrialization, denudation of the forest cover and the like may, of course, have an adverse effect on all salmon stocks over the long run unless offsetting remedial measures can be taken. Methods of spawning-ground management, like those suggested below for pink salmon, might be equally effective for chums. The fact that the requirements of both are somewhat similar, however, might lead to competition between them. In determining the optimum use of a given area of fresh water, a choice might have to be made as to which species or what proportion of each should be promoted; and pinks would probably be favoured in most cases on grounds of quality and as yielding quicker results. On balance, no change is expected in the abundance of chum salmon before 1980.

Except for runs to the upper Fraser and Skeena rivers, pink salmon spawn quite close to salt water, and the young migrate to sea as soon as they emerge from the gravel beds. Maturity is reached at an age of two years. They range beyond the continental shelf but evidently not to such distances as chum and sockeye do. About 70% of the catch is made with purse-seines and the rest with gill-nets. About 95% of the catch is canned.

The pink salmon runs to the upper Fraser River, where spawning is less affected than in coastal streams by variation in water levels, are responding to the same measures that are proving effective in re-establishing the sockeye runs. A like development is taking place on the Skeena River. In both rivers too, the possibility of power development holds a threat to the continued existence of these runs. The Fraser River runs constitute a somewhat special case in that they are subject to a marked two-year cycle and to intensive international exploitation. International competition for the catch has shifted fishing operations offshore, in order to intercept the fish at an earlier stage of their homeward journey. This makes escapement control more difficult. Recently, therefore, the issue of an international agreement for control of the fishery has been raised.

In general, apart from the upriver runs already mentioned, management of the pink salmon resources is being directed toward a) opening up new spawning areas, by surmounting or removing natural obstructions, b) controlling the water supply to incubation and migration areas, c) improving and constructing spawning beds, i.e. "artificial" redds, d) operating hatcheries and stocking streams to establish new runs, e) regulating escapement to particular streams and tributaries so as to produce an optimum density in the spawning populations and f) reducing predation on the emerging fry. The first of these operations is well established; others are the subject of experiment. Extensive application of most awaits costing study. Assuming no major setbacks to the fishery and the achievement of some success in measures for its management, it is estimated that total stocks may be increased by about 12% in the next 25 years and the catch raised about 20% over the present level.

Coho salmon are nurtured in a large number of coastal streams of all sizes and remain for a year in fresh water before migration to sea. They are, for that reason, especially vulnerable to the encroachments of civilization over the Pacific Coast watersheds. The species normally does not wander far from the continental shelf area. Maturity is reached predominantly in the third year. Two-thirds of the catch is taken in trolling operations offshore, the rest with purse-seines and gill-nets. There is also an important sport fishery for this species. Most of the commercial catch is used for the fresh, i.e. chilled and frozen, fish market. A substantial quantity also is canned.

Coho respond to stream improvement measures more readily than the other species and may benefit from management programmes undertaken

primarily for pinks and chums. Much of the loss that will almost inevitably result from changes in their environment, because of the progress of industrialization and the like, may be offset in this way during the next 25 years. On the assumption that it will, no change in the present stocks is predicted.

Spring salmon, like the sockeye, ascend to the headwaters of the larger rivers to spawn. The young normally spend but a few months in fresh water, however. They range for long distances along the continental shelf and are usually caught in inshore waters. Two-thirds of the catch is taken by trolling, the rest by gill-netting. There is a small but expanding sport fishery also. The greater part of the commercial catch is marketed in the fresh state and a substantial quantity is mild-cured (for smoking) as well.

Although the factors likely to affect the spring salmon stocks adversely — damage to the parent streams through industrial development, for example—may be offset partially by improved management programmes and control of the fishery, some reduction of these stocks is considered to be inevitable.

The Steelhead, belonging to a different genus from the species discussed above, are identified as the anadromous members of a species that may also live wholly in fresh water. In appearance and habits they resemble closely the Atlantic salmon. They occur in nearly all coastal rivers, where the young usually spend about two years before their sea migration. The spawning runs occur in summer or winter. The commercial catch is taken largely with gill-nets. There is also a considerable subsistence fishery by natives and a large sport fishery. Most steelhead stocks evidently are quite lightly fished. No change in these stocks is anticipated in the foreseeable future, but the catch in the sport fishery is likely to increase in importance.

The Atlantic salmon occur all along the coast from the Bay of Fundy to Ungava Bay. They spawn in late fall in coastal streams and the young, hatched the following spring, remain in fresh water from two to four years when, as smolts, they descend to the sea. At sea the races from the various streams range widely and intermingle very extensively. Most fish, however, return eventually to the home stream at the end of a year as grilse or later as salmon. The commercial catch is made with trap-net, drift-net and stationary gill-net. Practically the whole of it enters the fresh fish market. In addition, this species is the basis of the most important sport fishery on the Atlantic Coast. More than half the commercial catch is taken in Newfoundland, including Labrador, and a similar proportion of the angling catch is secured in the western part of the Gulf of St. Lawrence. The angling catch at present is about one-ninth of the commercial catch.

Atlantic salmon catches show a continuous decline since about 1930. This decline is associated with the rise in average annual ocean temperatures in the Atlantic Coast area, referred to earlier. The explanation for the observed inverse relationship between these two phenomena, assuming it is

not coincidental, may lie in a) the occurrence of high air temperatures and/or low rainfall on land with high ocean temperatures, which would reduce the habitat for salmon parr, or b) a reduction in the survival of smolts at sea because of high water temperatures. In either case, stocks would be reduced. Alternatively, higher temperatures may affect the migratory routes of salmon so that they avoid the netting areas—in which case, of course, the size of the stock would not be affected.

In any event, if there is a causal connection here, it might be expected to influence the fishery in an opposite direction following the downturn in ocean temperatures after 1960.[40] Partly on that account, a substantial increase is forecast for Atlantic salmon stocks. The forecast is also supported by the results expected from direct measures to increase stocks, e.g. a) the control of predation by the American merganser, which, it is believed, could multiply the stock of young salmon in the rivers affected from two to three times, b) the removal of, and the provision of facilities to surmount, obstacles (natural or man-made) to the ascent of streams by spawning salmon and thus, in some instances, doubling the smolt-rearing area, and c), in the case of certain areas inaccessible to spawners, initiation and maintenance of stocks by means of hatcheries.

Against these considerations have to be set the probable effects of flooding, erosion and higher stream temperatures resulting from logging activity, and of pollution from industrial and urban development. To the older sources of menace must now be added the spraying of forests in the interest of insect control, which appears likely to exterminate the salmon stocks in several important drainage areas. Such negative factors notwithstanding, it is estimated that by 1980 a net increase in stocks, up to 50% above the"natural" level reached at that time, might be achieved through a resolute programme of management. Stocks of this magnitude would yield a considerably larger commercial catch than the present, possibly 75% larger. A comparable increase would take place in the total angling catch, although, with a much greater number of anglers, the catch per man may well fall.

Herring

	Present Stock	PRESENT UTILIZATION				Probable Catch Trend	Prospective Stock, 1980
		Canada	Others	Total	Rate		
	million lb.	million lb.	million lb.	million lb.	%		million lb.
Atlantic . . .	3,800	240	—	240	6.3	increase	3,500
Pacific	790	380	—	380	48.1	increase	790
Totals	4,590	620	—	620			4,290

Atlantic herring, found throughout the continental shelf area (and, occasionally, farther offshore) from the Bay of Fundy to Hamilton Inlet, Labrador—being particularly abundant between 43° and 50° north latitude

—are probably the most numerous commercially utilizable species in Canadian waters. There are several discrete divisions of the total stocks: at least four south of the Laurentian Channel and four in the Newfoundland region. Herring occur usually in large schools and are capable of migration over great distances, up to 500 miles and more. Their movements are very irregular, in relation, possibly, to changes in hydrographic conditions. Spawning takes place, in shallow waters, from late April to mid-September.

Most of the catch is taken during the spawning runs close inshore in the coastal bays, e.g. Passamaquoddy Bay, the Bay of Chaleur, the Bay of Islands and Fortune Bay. It is taken mainly in weirs and trap-nets and with gill-nets. Purse-seining is being developed and, experimentally, the use of drift-nets and mid-water trawls, i.e. drag-nets. The catch is turned into a variety of smoked, pickled and canned products. There is a small reduction (meal and oil) industry and substantial quantities of herring are used for bait in lobstering and line-fishing. There is a number of by-products. The herring stocks today are under-fished — herring up to 20 years of age are not uncommon in commercial catches—and, for the most part, they are fished at a season when they are in poor condition. Improvement in the methods of locating and catching herring in offshore waters during the summer and fall months, when they are highest in quality, is necessary if the resource is to be utilized for a modern food industry. The prerequisite to such development, viz. a mass market for herring products, is discussed elsewhere.

Pacific herring are caught chiefly along the east and west coasts of Vancouver Island and in the channels tributary to Hecate Strait. The catch is taken with purse-seines during the fall and winter months. In certain areas the quantity taken is controlled by quota. Practically the whole of it is used for the production of meal and oil. No change is expected in the size of the total herring stocks of the Pacific Coast but these stocks are judged to be sufficient to sustain an increase of 35%, or so, over the present catch level. Exploitation on this scale, however, since it would reduce the fishery to greater dependance on the incoming year-class each season, would probably result in wider fluctuations in the annual catch. The strength of a year-class is determined, apparently, by the success of survival in the larval stage. Protective measures being inapplicable at this stage, there is no way in which the strength of individual year-classes might be influenced by such measures.

Lobster

	Present Stock million lb.	PRESENT UTILIZATION Canada million lb.	Others million lb.	Total million lb.	Rate %	Probable Catch Trend	Prospective Stock, 1980 million lb.
Atlantic	73	48	—	48	65.8	no change	67

Lobsters occur in inshore waters along the Atlantic Coast, from Massachusetts to northern Newfoundland. The eggs of this species are laid principally during summer, are carried[41] for a year and hatch the following summer. The young are pelagic and subject to surface-drift and to a high, variable mortality which causes considerable fluctuation in year-class strength. Growth is relatively slow: up to six years are required to reach a length suitable for canning and up to eight years for the live or shell-lobster market. Age at maturity varies from five to fifteen years, depending on environmental temperatures. The movements of lobsters, after they take up life on the bottom, are quite limited in range. They are caught, with baited traps, during regulated seasons. Minimum size regulations also are in effect. An increasing proportion of the catch is marketed in the live form but a substantial quantity is still canned.

The fishery is intensive:[42] it is estimated that about two-thirds of the legal-sized stock is taken annually. The increase in landings since the early 1940's is believed to be related to the higher water temperatures during this period. The trend is likely to be reversed, therefore, if, as predicted, temperatures begin to drop after 1960. This could be offset, it is thought, and the catch maintained at present levels until 1980 by an effective management programme.

Miscellaneous Sea Fish

Species	Present Stock million lb.	PRESENT UTILIZATION Canada million lb.	Others million lb.	Total million lb.	Rate %	Probable Catch Trend	Prospective Stock, 1980 million lb.
Atlantic:							
Swordfish	50	4	—	4	8.0	increase	50
Tuna	[43]	[44]	—	[44]	—	increase	[45]
Mackerel	[43]	30	—	30	—	increase	[45]
Shad	8	2	—	2	25.0	no change	7
Alewife	100	36	—	36	36.0	decrease	80
Smelt	40	6	—	6	15.0	decrease	35
Eel	[43]	[44]	—	[44]	—	increase	[45]
Squid	[43]	8	—	8	—	increase	[45]
Scallop	225	14[46]	—	14[46]	6.2	increase	180
Oyster	10	5	—	5	50.0	increase	50
Clams[47]	30	10	—	10	33.3	no change	28
Whales[48]	[48]	7,000[50]	—	7,000[50]	—	increase	[45]
Seals[49]	3,000,000[50]	178,000[50]	175,000[50]	353,000[50]	—	increase	4,000,000[50]
Seaweeds	100[51]	19[51]	—	19[51]	19.0	increase	100[51]
Pacific:							
Tuna	[43]	—	—	—	—	increase	[45]
Pilchard	[43]	—	—	—	—	no change	[45]
Anchovy	25	[44]	—	[44]	—	increase	20
Smelt	[43]	2	—	2	—	no change	[45]
Crab	8	4	1	5	62.5	increase	8
Shrimps	5	1	—	1	20.0	increase	5
Oyster	[43]	1	—	1	—	increase	[45]
Clams[52]	23	4	—	4	—	increase	[45]
Whales[53]	[48]	610[50]	—	610[50]	—	increase	[45]
Seal	2,000,000[50]	13,100[50]	58,400[50]	71,500[50]	3.6	no change	2,000,000[50]

A number of species, the most important of which are listed above, form the bases for several minor fisheries. Some of these may have considerable significance regionally, e.g. the scallop fishery in the Bay of

Fundy or the crab fishery in Hecate Strait. Others may provide a useful adjunct to major fisheries for different species, e.g. the swordfish catch supplements the groundfish catch of the Nova Scotian inshore fleet.

Among those listed, swordfish, tuna and mackerel, on the Atlantic Coast, and tuna, pilchard and anchovy, on the Pacific Coast, belong to the class of pelagic fishes. The Swordfish and the Bluefin Tuna are summer visitors to the waters east of Nova Scotia. The former is taken with harpoon gear, mainly off Cape Breton Island, and the latter chiefly at ports in western Nova Scotia, for the most part with special line gear. Tuna also provide the basis for an important sport fishery in this district. Canadians take the bulk of the annual catch of swordfish in eastern North America but only about one-fifth of the tuna catch. Both species probably could support a heavier catch at present but they may become less accessible to fishermen of this country if water temperatures drop appreciably over the next 25 years.

Mackerel are common along the Atlantic Coast, as far north as the Strait of Belle Isle. They are believed to winter east of the New England area. They appear on the coast in May and begin to move south again in September. About 25% of the North American catch is taken in Canada, most of it with gill-nets. Catches are subject to violent fluctuation, due to variation in year-class recruitment. The principal product is pickled mackerel, although there is some usage for reduction and for bait as well. The total stock is considered to be large in relation to the present level of utilization. Since it replaces itself rapidly — a high proportion of the species become spawning adults at two years of age — it constitutes one of the larger reserves of incompletely exploited fish populations.[54]

The Albacore Tuna and the Pilchard belong to stocks that occur as far south as California—the former may have an even broader range. They appear to be at the northern limit of their occurrence in Canadian Pacific waters. The appearance of both in these waters has been subject to very wide periodic fluctuation and during recent years, possibly because of changes in oceanic conditions, the stocks have been out of reach of economic operation by Canadian fishing fleets. Tuna are caught by trolling, ordinarily from July to September, and pilchard by purse-seining. The former are used for canning, the latter for canning and reduction. The tuna stocks are believed to be very large and capable of supporting greater exploitation by the Canadian industry if the problem of location and pursuit can be solved. The pilchard stocks, however, since they are heavily fished by the U.S. fleet, are considered unlikely to be of much importance to the industry in this country.

There is a small fishery for Anchovy, centred mainly in the southern inshore waters of British Columbia, during the months of June, July and August. The catch is used chiefly for canning. Information on the future

potential of this fishery, with reference either to the extent of the available stocks or to market opportunities, is meagre but does not encourage expectation of any considerable expansion.

The shad and alewife[55] and the smelts are estuarial or anadromous species. Shad spawn in the rivers of the Bay of Fundy and the western Gulf of St. Lawrence in May and June each year, and in late summer the young descend to the sea where they remain until maturity. The catch is made, with trap-nets, etc., generally in the tidal estuaries on the return journey to the spawning grounds. This species is particularly vulnerable to the effects of pollution in its native streams and, therefore, some diminution in stock may be expected over the next 25 years.

The Alewife stocks are based on rivers, like the Saint John, draining lakes where, in the late spring, spawning chiefly takes place. The young descend to the sea in the late summer and early fall and mature in salt water. The adult fish are taken in the rivers and estuaries on the return spawning run. Most of the catch is cured in one form or another. Since this species spawns in lakes, it is not subject to serious deterioration in its environment from the effects of pollution. Cooler water temperatures, however, may reduce the size of the total stock.

On the Atlantic Coast, the Smelt is found chiefly in the Gulf of St. Lawrence where the stocks remain in close proximity to the river mouths. Spawning takes place during the spring in small tributaries. Most of the commercial catch is taken in the estuaries from the early stages of the spawning run during the autumn and winter. More than a third of the total catch is taken from the Miramichi River system. Trap-nets and gill-nets are used, sometimes set under the ice. The catch is frozen for the fresh fish trade. This species is susceptible to the encroachments of human settlement and industry on its habitat and, although careful management might have some offsetting effect, the stocks are expected to decline in the years to come.

The Capelin, a species related to the smelt and abundant in the coastal waters of Newfoundland, may be mentioned here although it is not an anadromous fish. Its spawning runs inshore each summer provide the foundation of the trap fishery for cod, referred to earlier. These runs ordinarily last for less than a month in any one district and profitable utilization for processing is therefore very difficult. Most of the current catch, which is quite large, is used for bait and fertilizer.

The principal smelt species of the Pacific Coast is the Eulachon, which spawns in the lower reaches of the larger rivers there. Most of the catch is taken in subsistence fishing by the native population. Like other smelts, the species is vulnerable to the pollution of its native streams by expanding industrialism and significant development of the fishery is considered unlikely.

Eels occur in commercial quantities along the Atlantic Coast north to Newfoundland. These fish migrate up rivers to mature in fresh water. At eight to twelve years of age they return to deep ocean waters, to spawn and die. Catches are made in the fall by trapping the seaward migration. The total stocks evidently are large and it is estimated that an annual catch of at least 10 million lb. could be taken if required.

The Pacific stocks of Crab are located on sandy grounds in shallow water, off the lower Mainland, on the west coast of Vancouver Island, in Hecate Strait and in Dixon Entrance. The eggs are spawned in autumn, carried through the winter and hatched in the spring as free-swimming larvae. These settle on the bottom after about four months' time and maturity is reached during the third year. The male reaches legal size in the fourth or fifth year—the fishery is practically limited to the male of the species. The greater part of the catch is taken by trapping, the remainder incidentally in dragging operations. The stocks are believed to be heavily fished but some addition to the Canadian catch may be obtained at the expense of the catch by United States vessels.

Six species of commercially utilizable Shrimp are found on the Canadian Pacific Coast. The life histories of these species are similar to those of lobster and crab. Breeding takes place in the late fall and early winter and hatching in the early spring. The young swim freely for about three months before settling on the bottom. Shrimps mature first as males, in the first or second year, and later, after one or two seasons, change their sex. Five of the species occur on mud or sandy bottom and are caught with drag-nets. The other species, known as prawn, is taken with traps on rocky grounds. The fishery at present is carried on along the east coast of Vancouver Island and at points on the southern and central mainland coast. It is estimated that a catch level two or three times higher than the present may be achieved, partly by more intensive fishing of known stocks and partly as a result of locating new stocks.

Crabs are known to be abundant in certain parts of the Canadian Atlantic Coast area, as well—the stocks are estimated to be sufficiently large, indeed, to support a catch up to 10 million lb. per year. There are also a number of species of shrimp in Canadian Atlantic waters, although none is known to be sufficiently concentrated for profitable exploitation at current price levels.

The appearance of Squid in Canadian waters is restricted mainly to the coast of Newfoundland. The stocks appear to fluctuate widely in quantity from year to year but such fluctuations have not been traced to any known trends in ocean temperature, for example. The catching technique in general use, i.e. jigging, is primitive and inefficient. The principal use for the species at present is as bait in the line-fishery for cod—it is twice as productive as any other species that has been used for

this purpose. Squid may also be utilized for food, and it is estimated that the average annual catch could at least be doubled.

Scallops occur in Atlantic Coast waters, in commercially significant quantities, between Cape Cod and Newfoundland. The species has an early free-swimming stage before settling on the bottom and consequently the best locations for fishing change through time. Rotation of fishing grounds is desirable, therefore, especially offshore. The catch is made with dragging gear. Only a small part of the scallop meat is utilized for the market. The principal inshore fishery is based on the port of Digby and there is also an important inshore fishery in Port au Port Bay. The main offshore grounds are on George's Bank and St. Pierre Bank; others may be discovered. The offshore grounds, of course, are accessible to other nations and may eventually need international management.

The Oyster thrives in shallow warm waters of somewhat low salinity. In the Canadian Atlantic area, suitable conditions occur only in the southern part of the Gulf of St. Lawrence and in the Bras d'Or Lakes. The young of the species are free swimming for some three weeks before settling to the bottom. In both stages they are subject to heavy mortality from a variety of hazards and enemies. Survivors reach a marketable size in four to six years. Oysters are gathered with rakes and tongs. Production is divided about equally between the "wild" or natural stocks in the public domain and cultured stocks on leaseholds. The total crop is marketed in the shell. The fishery on both public and leased grounds suffers from a shortage of seed stock. Sets of oyster larvae in commercially significant quantity do not occur every year, partly because of adverse water temperatures. This causes the public fishery to fluctuate at a low level and also seriously hampers the oyster farmer, who must collect the wild seed. The leaseholds, principally for that reason, are considered to be producing at only about one-tenth of their potential capacity. Prospects for an improved seed supply and for favourable water temperatures are quite good, and a fivefold increase in total stock is forecast.[56]

On the Pacific Coast, most of the oyster production comes from leased inter-tidal grounds in the Strait of Georgia. Inadequate seeding limits production here too: the average production of the leased grounds is about a third of their potential. Apart from improved seeding, for which a reliable source now appears to be available, production may also be increased by bringing new grounds under cultivation and possibly by new culture techniques.

The clam fisheries of the Atlantic Coast are based principally on two species: the Soft-shelled Clam and the Quahaug.[57] The former, the more important of the two, is found quite widespread throughout the area in the intertidal zone. The distribution of colonies large and compact

enough for commercial exploitation is discontinuous, depending on suitable soil conditions and other environmental factors. Growth is slow, marketable size being reached only after four to six years. The mortality rate from natural predation and damage to the stocks in digging operations is high: about 50% per annum. The fishery, utilizing all available stocks, appears to be approaching a stable production level of about five million lb. a year. Pollution of coastal waters by domestic sewage, slowly increasing, tends to restrict this fishery. Lower water temperatures—which might reduce the incidence of the green crab, considered to be the chief predator—are not expected to affect the catch substantially.

The critical spawning temperature for the quahaug is relatively high and, in Canadian waters, is reached only in the shallower parts of sheltered bays with wide, sun-warmed intertidal flats in the southern part of the Gulf of St. Lawrence. The species may be cultured, or farmed, successfully, but the possibilities of expansion in this direction are limited by low and sporadic natural seed production. Mention may also be made of the Bar Clam, widely distributed in the Atlantic Coast area but nowhere abundant enough to encourage intensive exploitation at present. The species is slow growing and does not lend itself to culture.

Three species of clam are fished on the Pacific Coast. The most important of these is the Butter Clam, widely distributed in this area. Practically all the important beds are being utilized and, since growth is slow and reproduction uncertain, no increase in yield is predicted. Farming is not considered feasible under foreseeable conditions. Commercially significant quantities of the Little-neck Clam, the species[58] second in importance, occur only in the Strait of Georgia. A substantial increase in production seems unlikely. The principal stocks of the Razor Clam are found in the sand beaches of the Queen Charlotte Islands. The extent of these stocks is unknown but a considerable increase in current production, which is almost negligible, seems possible.

Whales are pelagic and migratory marine mammals, and Canadian coastal waters include only a small part of their range of distribution. Those sustaining the whaling industry in this country are mostly transients alternating between winter breeding grounds in low latitudes and summer feeding grounds in high latitudes. The species of major importance at present are a) five baleen whales, viz. Blue, Finback, Humpback, Sei and Minke, and b) three toothed whales, viz. Sperm, White and Pilot or Pothead. Others, e.g. the Killer Whale, are also known to exist in abundance.

The largest whaling operation in Canada is based at Coal Harbour on the west coast of Vancouver Island. Whales are taken here during a six-month period from April through September, mostly within 150 miles of the station. The principal concentration of whale stocks in the

north Pacific appears to be in the neighbourhood of the eastern Aleutians, out of reach of land-based operations in Canada. Whales are killed by specially designed catcher vessels using an explosive harpoon. The species taken in largest numbers are the finback and the sperm, neither of which appears to have suffered depletion under the pressure of whaling in this area. Stocks of blue and humpback whales, on the other hand, have declined rapidly everywhere under heavy attack. Sei whales have not been exploited as intensively as the other species mentioned, owing to their relatively small size and low yield of oil.

Expansion of the fishery would seem to depend directly on the extent to which the catch may be utilized for food, for animal feeding[69] or for human consumption, as well as for oil production. This would involve improvement in catching equipment and methods to prevent deterioration of the carcasses and, possibly, the use of factory ships to permit full utilization of the stocks where and when they may be found in greatest concentration and of the best size and quality.

The whale fishery was formerly prosecuted for many years off the Canadian Atlantic Coast, chiefly from bases in Labrador and northern Newfoundland, but operations were closed down following the postwar decline in the market for fats and oils. In recent years, the finback was by far the most important species in the catch. Fairly large stocks of sei and sperm are also known to exist within range of stations located in the region referred to and there are stocks, as well, to be found south of Nova Scotia. Altogether, it is estimated, about five million lb. of whale meat could be recovered annually in this area.

One whaling station continues to operate on the Atlantic Coast, at Dildo in Trinity Bay. This station handles the small whale species, i.e. pilot whales chiefly and some minke whales. Occasionally, larger whales are taken. The pilot whales are captured intermittently, by bar-seining, in drives of varying numbers. Oil is now a relatively minor product and utilization of the meat for animal food is the primary objective. The stocks of both species mentioned are unknown but presumed to be large. No use is currently being made of the comparatively small White Whale stock found in the St. Lawrence River estuary. There is a minor whaling operation at Churchill on Hudson's Bay, using the white whale for the production of oil and animal food.

The whale fishery is regulated by the International Whaling Convention of 1946, to which Canada is a signatory. The terms of the Convention restrict the taking of certain species and of females accompanied by calves, impose minimum length limits for each species, control the length of the catching season and restrict factory ship operation in specific areas. The Bowhead or Right Whale and the Gray Whale are completely protected from exploitation. The hunting season for other baleen

whales is set at six months. Factory ship operations are prohibited in the north Atlantic and, except for sperms, in part of the north Pacific.

The seal hunt or fishery of the Canadian Atlantic Coast is based principally on the Harp Seal, a migratory species that occupies areas of open water in the Davis Strait region during the summer and fall and the southern area of pack ice in the early spring for whelping and breeding purposes. The hunt takes place during the latter season among the ice fields east of Newfoundland and Labrador, i.e. the so-called "front", and in the Gulf of St. Lawrence. The white-coated pups are the chief object of the hunt but, in recent years especially, a considerable number of older animals have been taken as well. The principal products are fur and oil.

While expansion of this fishery is not considered likely, something could be done to stabilize it. The most urgent need is for protection of the breeding stock. This could be provided by closing the season on April 15, before the pregnant females return to the ice pack to moult. At present, apart from an informal agreement on opening dates, there is no international control over the hunt and the kill. Small numbers of the Hooded Seal are also taken in the hunt, but the stock is probably in decline because of the number of adults destroyed in the capture of the young, and closure of season for this species may be desirable.

The important seal species of the north Pacific is the Fur Seal. The members of this species congregate in summer to breed on groups of islands in the Bering Sea, the largest herd being that of the Pribilof Islands owned by the United States. During the remainder of the year, the seals are found in the open sea—they migrate southward as far as California, on the eastern side of the Pacific. The species is sought for its fur exclusively. In 1911, following three decades of intensive pelagic sealing which decimated the herds, the Pelagic Sealing Treaty was concluded. Under this treaty, full control over the taking of seals from a particular herd was given to the nation owning that herd's breeding ground. The other nations concerned were given a fixed share of each season's kill, to indemnify them for losses due to the prohibition of pelagic sealing. Canada obtained 15% of the skins from the Pribilof herd and also a proportion of the skins from the Asiatic herds. In 1942, following its abrogation by Japan, the treaty was replaced by a provisional Fur Seal Agreement between the United States and Canada, giving this country 20% of the annual yield in skins on the Pribilofs. Sealing in the Pacific is still regulated by this agreement.[60]

Under protective management, the seal herds have reached, or are rapidly reaching, their natural growth ceiling, i.e., the ecological equilibrium of the stocks is being restored. That being the case, little further increase in the share accruing to Canada can be expected. The relationship between fur seals and other marine resources may be a factor in future management policy. Seals are predatory to a significant extent on

commercially important food fishes and they also compete with the latter for food supplies. The optimum size of the seal population is therefore uncertain.

The only seaweed harvested in significant quantity in Canadian waters at the present time is Irish Moss, obtained on the rocky outer coasts of Nova Scotia and Prince Edward Island. The moss is usually collected by hand-raking. It is dried for the market, the extract having a considerable range of industrial uses. A substantial increase in the annual crop is possible. There is also a small production of dried dulse each year on the Atlantic Coast, chiefly on Grand Manan in the Bay of Fundy.

In addition to the species already discussed, there are several that support minor commercial fisheries and offer no possibilities of expansion. Examples are Striped Bass and Arctic Char, anadromous species found in the Maritimes and in northern Labrador, respectively, and the Abalone, a mollusc of the Pacific Coast. The striped bass, incidentally, is an important game fish.

On the other hand, there is a number of species, at present unexploited, that represents potential supplies of food and industrial products. The Mussel, the most abundant shellfish on the Atlantic Coast and also plentiful in Pacific waters, is a case in point. The sharks (other than dogfish), at least six species of which are found in the waters off both coasts of Canada—usually as summer visitors—are another: many are suitable for human or animal feeding or for reduction purposes. There are also vast stocks of kelps and other seaweeds, important sources of algin and agar, awaiting utilization on both the Atlantic and Pacific coasts of this country.

In this connection, reference may be made to an unutilized resource of the Canadian Arctic, viz. zooplankton. The standing summer crop of plankton organisms is reported to be very heavy in northern waters, especially in the sub-arctic belt where polar and Atlantic waters mix. The cold water, slow growth and scarcity of enemies in this region permit the accumulation of plankton suspensions possibly dense enough to make harvesting feasible. The technological difficulties in the large-scale collection of plankton and its conversion to edible form are not considered insuperable.[61]

Finally, reference should be made to the possibility of introducing new commercial species into Canadian coastal waters. The important considerations in this connection are a) that the transplanted species should make use of a food supply not already used by an indigenous commercial species, and b) that, if substitution of one species for another is intended, the new species should be more valuable than the old.

The marine fauna of the north Pacific is the richest of any temperate region and it is very difficult to find a species that might fill an ecological gap there. The only obvious gap is the relative scarcity of crustaceans, and the eastern lobster appears to offer the best possibility of filling it. There are areas of considerable extent that would seem to provide a suitable habitat. Lobsters do not favour the sandy bottom preferred by the Pacific crab and no competition should develop between the two species. Experimental transplants, however, have not been successful.

The Atlantic Ocean in northern latitudes is comparatively poor in variety of species. To make good some of this deficiency, the introduction of the European flat oyster, the Pacific crab and several of the Pacific salmon species has been suggested. The Flat Oyster lives and spawns in water somewhat cooler and saltier than is tolerated by the native species. Its successful introduction might establish a much larger oyster industry than the present in the Atlantic provinces. The Pacific crab could become a useful resource on the sandy grounds of the Atlantic Coast, which now lack a crustacean of commercial importance. The sockeye, pink and chum might be suitable Pacific salmon species for transplantation to Atlantic Coast waters. There are no salmonoids there with a similar life history. Since they require no food in their river migrations, they would not compete with the native salmon. These proposals have not yet reached the trial stage.

Freshwater Fish

A comprehensive survey of freshwater fish stocks could not be undertaken in the time available, not because of the diversity of species but because of the large number of the bodies of water involved and their varying characteristics. The most productive lakes are those fed by streams high in dissolved solid content, i.e. draining lands formed of drift overlying sedimentary rocks, as in southern Ontario and on the Prairie. Lakes in the precambrian region tend to be low in nutrients. Generally, also, the shallower and warmer lakes support denser stocks of fish.

The major freshwater fisheries of Canada are established chiefly on the larger and more accessible inland lakes. The most important are the Great Lakes[62] in Ontario, especially Lake Erie and Lake Huron, the three large lakes in Manitoba, especially Lake Winnipeg, the Lesser Slave Lake in Alberta and the Great Slave Lake in the District of Mackenzie. The present extent of these fisheries may be summarized as follows:

Species	Current Catch (annual average) million lb.
Pike-perch[63]	29
Whitefish	24
Ciscoe[64]	11
Yellow Perch	8
Pike[65]	6
Grey Trout[66]	6
Other[67]	30
Total	114

The bulk of the commercial freshwater catch is taken in lakes, but some quantities of several species are caught in rivers. With a few exceptions, e.g. sturgeon, which may be taken with line gear, all freshwater species are taken with trap-nets and gill-nets of various kinds. The catches are utilized for the fresh (chilled and frozen) fish market, small quantities of certain species being filleted and others smoked.

It is considered that, with appropriate management practices, the stocks of commercial freshwater fish could sustain an over-all increase of about 40% in catch levels. Most of this increase, however, is estimated for the coarser species, i.e. species other than whitefish, pike-perch and trout, although significant increases are predicted for the latter too. Nearly the whole of this increase is expected to be achieved in the fisheries of the Prairie Provinces, and most of the remainder in Ontario.

In this connection, it should be noted that prospects for increased use of the stocks of the major commercial species in the nothern lakes of western Canada will depend to a large extent on the expansion of suitable transport facilities in those districts. At the same time, it should be noted also that possible improvements in the catch of trout, for example, in the Great Lakes, as a result of projects in progress or planned under the International Great Lakes Fisheries Convention,[68] are not included in the above forecast.

Substantial quantities of the coarser freshwater fishes are now being used for animal feed on fur farms and for pet food. These requirements may be expected to grow as alternative sources of supply, e.g. horse meat, diminish, and to promote further expansion of the fisheries. Nevertheless, it may also be expected that the commercial freshwater fisheries, like some of the sea fisheries, will be encroached upon gradually by the domestic sport fisheries.

Prospects for expansion of Canada's sport fisheries appear excellent. These favourable prospects arise not only in the increasing demand for sport fish resources but also in the extensive opportunities that exist for

expanding the supply of those resources within the next few decades. The extent of the demand may be indicated by the rapid growth in the number of anglers since World War II. By 1955, freshwater sport fishermen were estimated to number almost 1.6 million, i.e. about 10% of the population. Salt water anglers, not included in this number, would add substantially to it—in British Columbia there were about 25,000 such fishermen in 1954. A very large increase in the numbers of anglers is forecast in most provinces: totalling about 80% during the next 25 years. This might mean as many as 2.5 to three million sport fishermen by 1980. Forecasts of Canada's 1980 population would indicate this to be a reasonable estimate if the present ratio of one sport fisherman for every ten people in the population continues to be maintained.

In the Atlantic Provinces and British Columbia the major sport fisheries are for salmon and trout. In the three Prairie Provinces, on the other hand, pike fishing greatly exceeds any other sport fishery—in Alberta, for example, the catch of pike is estimated at five million pounds or five-sixths of the total sport catch. In Ontario, the sport catch comprises pickerel, pike and small mouth bass for the most part.

Although the present sport fish catch is large—estimated at 33 million pounds, it would exceed the present commercial catch of whitefish and lake trout combined—it is expected that it may be almost doubled during the next quarter century. This doubling of the catch, however, is, in the main, based on the potential sport fish resources in Canada rather than upon the prospective catch per angler. In fact, as indicated above, the potential increase in sports catch is estimated to be greater than the expected increase in number of anglers. This suggests that the number of anglers could increase more than the number in the forecast above without any fall in the catch for each angler — which would require, probably, that more sport fishermen in future fish in what are now relatively inaccessible lakes and streams. Highways and other transport facilities are, of course, progressively making more of these waters available for recreation and it may be expected that progress in providing transportation will continue to open up such areas for sport fishing.

It should be noted, however, that as far as the whole economy is concerned the significance of the sport fisheries will be found largely in the value of these transportation services and the other tourist services that may be provided for the fishermen, rather than in the "value" of the sport fish they catch. Because of this, the importance of providing fishable stocks in numerous lakes and streams may tend to increase. In other words, the maintenance of hatcheries and other effective fishery management activities for the sport fisheries is likely to become increasingly important in Canada.

3

THE PRODUCTS

THE UTILIZATION of fish for food purposes begins with the catching operation, in which hooks or nets are used to remove the fish from their aquatic environment. Generally speaking, the transfer from water to atmosphere is followed quickly by death, and post-mortem changes in the body begin almost immediately. The commercial processing of fishery products starts with the first steps taken to restrict or prevent the progress of these changes which are responsible for deterioration and ultimate spoilage of the flesh.

Preservation is a general requirement in all food processing and distribution, but there is considerable variation in the nature of deterioration among the major food items and, therefore, in the preventative methods which must be used and the costs involved. The preservation of grain, for example, can be accomplished by protecting it from external hazards: weather, rodents or vermin. Fruit presents a more difficult problem because of the additional hazards which result from changes that occur internally and which can only be controlled by exposure to specific conditions of temperature, humidity and atmosphere.

In the group of foods which originates with the flesh of animals, fish products pose the severest problems in preservation, especially of the desirable qualities associated with flavour, odour, texture and appearance. Spoilage, in the ordinary sense of decomposition by bacterial action, can be retarded or checked by several conventional means but all such methods, with the exception perhaps of freezing under ideal conditions and the use of antibiotics, change these original characteristics to some degree, and usually to a substantial degree.[1] In addition, the rate of spoilage in fish flesh is rapid, relative to meat, for example, and the time element is a substantial factor in the preservation process. In part, this acceleration of spoilage may result from the nature of the fish muscle as compared with that of land animals. In water the body of the fish is supported over its entire surface and the skeletal structure and musculature differ from those of pigs, for example, with body weight con-

fined to a small area of support. Fish muscle may be described as "delicate" in the range of animal muscle, and hence more subject to post-mortem changes.[2]

In spite of the extensive research which has been carried on in the field of fish spoilage, many questions remain to be answered[3]. Autolysis, proteolysis and rancidity, along with bacterial decomposition, now are identified as the group of processes that contributes to spoilage during the chain of events that brings fish from the sea or lake to the table. In point of time, the earliest hazard is the bacterial invasion when the fish are gutted, and for most commercial species this takes place on the fishing vessel. When the fish is alive the flesh is sterile, for all practical purposes, but the skin and protective slime carry large bacterial concentrations.

Gutting, or gutting and heading, provides an opportunity for the transfer of these bacteria to the flesh, and with this invasion the way is opened for subsequent decomposition. Washing and icing have been used at sea to impede this process but the efficacity of washing to remove slime is in question if it is carried out on deck in the traditional fashion.[4] The control of temperatures by icing is not an entirely satisfactory way of inhibiting the growth of these bacteria but better control is promised by the combination of chemical bacteriostats with ice. To complicate the problem, preservation activities on board ship must take place under conditions which make optimum sanitation and temperature control extremely difficult. Any deterioration which takes place as a result of the bacterial invasion of flesh or the chemical changes that begin with death cannot be rectified by any subsequent operation. Fish that comes stale from the vessel can only remain in that state or become staler.

The control of deterioration at the plant processing stage can be carried out with fewer practical difficulties than are encountered on board a fishing vessel. In spite of this, the special characteristics of fish flesh present very real problems throughout the entire processing operation. Until the process of preservation is completed—whether by salting, freezing or canning—time is of the essence because of the speed at which deterioration takes place. Good sanitation, the use of ice and of chemical bacteriostats do not eliminate the undesirable changes; they merely slow down the rate at which they occur.[5] The practical difficulties in controlling deterioration add to the particular problem in plant management arising from the considerable degree of uncertainty about the available day-to-day supply of fish. Weather and the abundance or scarcity of fish on the normal grounds are the two factors which contribute most to this uncertainty. If costs were no object plants could be built with sufficient capacity to process the maximum supply of fish that might reasonably be anticipated, in order to minimize the possibility of deterioration due to time lost in processing. In actual practice, however, a plant of such

a size would be operated throughout the greater part of the season at a small percentage of capacity and costs per unit of product would be prohibitive. The natural tendency in the industry has been to compromise in the matter of plant capacity and to expect gluts of raw fish from time to time. When supplies are larger than the plant production lines can accommodate, the surplus is binned for processing later and deterioration is controlled as far as possible by cooling the fish with ice.

The special efforts made to minimize deterioration at sea and in the processing plants must be continued, in the case of iced and frozen products, throughout the period until the goods are consumed—which means refrigerated transportation and refrigerated storage at coastal points, at interior warehouses and at retail outlets. In the case of frozen products, the refrigeration system must produce temperatures lower than those required for ordinary cold storage if quality is to be maintained throughout the so-called shelf-life. The present system of refrigerated transportation in this country does not provide, except in rare cases, the temperatures and humidity ranges which have been established as necessary conditions for the control of deterioration during the distribution of fishery products.[6]

In this section reference has been made to deterioration and spoilage, and a distinction should now be made between these two terms which actually refer to two stages in the decomposition of fish flesh. Spoilage, of course, is the end product of decomposition and in fish is all too readily identifiable from organoleptic evidence. It marks, or should mark, the product as not being fit for human food. There is no such clear-cut basis for the recognition of deterioration, although a considerable amount of research has been devoted to developing objective tests which would give a quick and reasonably accurate measurement of the progress of this process.[7] Most species of fish, when cooked within a few hours of capture, have a delicate and piquant taste. It is probably this same taste that creates the demand for lobsters and oysters and, with the limited supplies, enables these two species to command prices from consumers as high as any food product on the market. Both lobsters and oysters can be distributed alive, and their unique flavour is not diluted or reduced in the process. The primary appeal of fishery products to consumers in this country and in the United States is based ordinarily upon the special taste sensation which they can provide. This desirable characteristic is associated with freshness and its enjoyment can only be realized by immediate consumption or as a result of applying some process that preserves the qualities of freshness.

The same sort of consideration is apparent in the case of some of the agricultural foods, especially frozen fruits and vegetables and their products. Modern merchandizing emphasizes such terms as "garden fresh" and "right from the vine." Here the emphasis and the sales approach is entirely in terms of the preserved taste of the fresh product. To some

extent, the appeal is also based upon consumer convenience, but there is little difference in this respect between, say, frozen and canned peas. In the United States, a section of the fruit and vegetable industry has moved its operations to the fields, and harvesting is immediately followed by freezing at the site. Management now combines varieties, planting time and long-range weather forecasts to arrange a production cycle which utilizes harvesting and freezing capacity to the optimum extent. These technological advances have been brought about to preserve one characteristic of the products involved, and the demand for fast-frozen fruits and vegetables is attested by the growth of the industry in the United States, where production is estimated to have increased from 200 million lb. in 1938 to 1.6 billion lb. in 1955.[8]

Deterioration in fishery products can be regarded, therefore, as the diminution of a valuable market characteristic at a rate proportional to the length of time from death to consumption or from death to the point at which preservation arrests this process. The food value of the product is not affected, at least in terms of consumers' general knowledge, until the signs are unmistakable that the spoilage stage has been reached and the product is unacceptable for human consumption.

Methods of Preservation

In spite of the extreme difficulties presented in the preservation of fish, man has been concerned with overcoming them from the beginning of recorded history at least. In some early civilizations, fish flesh was more important in the diet than animal flesh; and war, exploration and commerce all demanded a supply of preserved fish which would remain edible for months and which could vary the monotony of a diet of salt beef and pork. The seasonal pattern of agriculture has always been marked by heavy supplies of meat, milk and cheese during the summer and fall and by shortages in the late winter and early spring. Before the age of cool storage, the larder had to be protected against the lean months by supplies of preserved meat and fish and of root vegetables carried through the winter.[9]

Drying was probably the earliest method used to preserve meat and fish over long periods of time. Drying changes the environment of the bacteria responsible for decomposition and the lowering of moisture levels in the flesh retards their multiplication.[10] In areas where history was first written, climatic conditions quite probably provided man with natural, if accidental, examples of preservation by the action of warm, dry air on animal or fish flesh.

Drying can also be accomplished by the application of dry salt or brine to the flesh to be preserved, with a bacteriostatic action similar to that which takes place in air drying. This method of saving food is so old that its origins are lost in time but, where descriptions of food and food

preservatives are available, they contain many references to the combination of salt with meat and fish. The great advantage of salting over air drying lies in its independence of the vagaries of air temperatures and humidities. Historically, however, salt has been a very expensive commodity at certain times and in certain places and has been a scarce commodity when war or governmental restrictions obstructed its movement in trade. Over the centuries, the two methods have been combined wherever food has been preserved in this fashion. Under the best of circumstances, drying in the open air is a chancy operation. There is always the danger that sudden weather changes may result in spoilage during the drying period or that long spells of unsuitable weather may preclude any attempts at drying and so preserving valuable food supplies.

When the preservation process was begun by salting, the subsequent risks of poor drying weather were considerably reduced because the salt-bulk could either be held for a period of time in the hope of better weather or shipped to areas with a more consistent climate. The combination of salting and drying was widely adopted in Europe, and literature dating from the Middle Ages contains many references to refinements in the general method, to the characteristics of the various types of salt used and to the substantial trade based upon salted products. This whole cultural complex was founded entirely upon empirical knowledge; the role of bacteria and enzymes as causative factors in spoilage was unknown and the specific effect of salting and drying could not be related to the processes which they retarded. Nevertheless a high degree of skill was represented in the industry and, where care was exercised in the interests of quality, the products may well have been superior to those produced by the same methods today.

This process, however, was not effective when the raw product was fatty or oily. No amount of salting or drying could prevent the appearance of undesirable colour and odour in salmon and herring, for example. Spoilage in these cases is caused by oxidation of the unsaturated oil in the fish flesh through contact with air. The first intimation that this could be controlled probably was fortuitous, i.e., when open fires were used to cook fish. If oily fish are exposed to the smoke of wood fires the phenols react with the fat or oil and rancidity is substantially reduced.[11] Early man is pictured as a gorger of food: when it was plentiful he ate to repletion and, to some extent, stored supplies against the morrow within his body. A good catch of fish, cleaned and hung by the fire, might often have proven more than the primitive group could eat, and the leftovers, smoking as long as the fire continued, would have been investigated again when hunger returned. Thus conjecture suggests the association of smoking with retarded rancidity at a very early stage of man's social development.

Rancidity can also be controlled by excluding the fish from contact with the atmosphere. This process presented early man with technical

difficulties and the method was probably not used extensively until the Middle Ages when the art of "tight coopering" provided barrels that would retain brine and exclude air. The combination of salting, smoking and coopering made possible the substantial use of herring for food — to the extent, in the 14th and 15th centuries, that the fortunes of nations depended upon this species. Coopering was, in principle, a forerunner of canning, which appeared some 500 years later. In the early method, the sterilization of fish was partially accomplished by salting, and the container, filled with brine, excluded the air from the salmon or herring—the same species now particularly associated with canning.

Curing, then, appeared very early in history and Dr. Cutting suggests that it was used during the Bronze Age in Britain.[12] New products evolved when the use of these processes, alone or in combination, resulted in changes in the colour, taste and texture of the fish. When salt pickling was extended to include sugar, vinegar and spices the range of products was multiplied many times. The extent to which the combination of these bacteriostatic and anti-oxidant operations evolved new products is evident in the wide range of forms in which herring especially is now processed.[13]

Further advances in fish and meat preservation had to wait upon the industrialization of the European and North American economies. Steam power for sea and rail transportation reduced the time required to move fish from the grounds to the wharf, and from the wharf to the consumer. In countries where distances are small, e.g. the United Kingdom, this reduction in transportation time made it possible to use ice as a bacteriostat and to provide consumers removed from the coasts with nearly fresh fish. Under these conditions ice is not a preservative to the same degree as is drying. While it slows down the proliferation of bacteria, it is not lethal and, of course, must be replenished as melting advances. However, it did provide a means of serving the growing cities with a product which had not been drastically altered by salting, drying or smoking and thus conditioned consumers to the fresh product — or something rather close to it. In these countries, the products preserved in ice from vessel to market replaced the cured forms to a considerable extent and, incidentally, brought serious dislocation to the fishermen and processors utilizing the older methods.

While icing was adaptable to fish distribution in the relatively small countries of Europe, it was only an effective agent in the fisheries of North America for the markets at, or close to, the coasts where fishing was carried on. Fishing and fish curing had become established on this continent early in the 16th century.[14] The fishing crews sent out from England, France and other countries to Newfoundland, and the first settlers of the Maritime Provinces and New England, brought with them the methods, processes and skills that were current in the old countries. For over 300 years, the products derived from the fishery resources of the western

Atlantic were preserved by curing until the canning process reached a stage of technological development that permitted its general use.

During the centuries when the preservation of fish was restricted to curing—principally salting and drying—on the Atlantic Coast from Newfoundland to New England, several typical cures developed which are still represented in the salted cod produced in the Canadian Atlantic Provinces today. The Newfoundland light-salted type, for example, emerged because circumstances forced the English crews and settlers to husband their scarce supplies of salt — it was applied lightly to the fish and air drying completed the preservation process. In Nova Scotia, trade with the West Indies provided ample supplies of salt and the typical cure developed as a heavy-salted type.

Like the Newfoundland light-salted process, canning was a development associated with war. Napoleon's armies required preserved food, and bounties offered by the government spurred experimentation. Basically, the process involves the sterilization of the food product by the use of heat and the prevention of bacterial reinfection from the air by hermetical sealing. In the pioneering stage, little was known about bacteria and their contribution to spoilage, and experimental work and commercial attempts to utilize the process received severe setbacks on several occasions in France and the United Kingdom. Fish canning experiments were carried out in New Brunswick in 1840, using salmon as the raw product. In 1869 another venture was tried in the canning of lobsters and salmon from Bay Chaleur.[15] New developments over the next 70 years—retorting, high temperature steam, automatic cutting and closure—all contributed to greater certainty in the method as a means of preserving fish and to the reduction in unit costs which were associated with the original hand method of filling and sealing.

By the beginning of the 20th century, curing and canning provided a means of preservation that enabled fishery products to be distributed widely in world trade. Salted codfish could be sold to consumers in the interior sections of countries like Puerto Rico and Brazil, and spoilage in these hot and humid areas was delayed by as much as a year in the case of the heavy-salted, hard-dried types. Canning provided protection almost indefinitely and canned products could be stockpiled and distributed over long periods of time irrespective of normal climatic variations. Both of these processes, however, resulted in substantial changes in the original characteristics of the raw products. The sterilization of canned fish results in a cooked product with a flavour unlike that of the raw product, and curing brings about more obvious changes in flavour, colour, odour and texture. Some of these changes, which are inherent in both processes, were accelerated or accented by the addition of flavouring materials. To some extent, these new products represented a recognition of the changes brought about by the preservation methods and, because consumers accepted such

changes, wider acceptance was sought by the addition of flavourings that were also commonly used to enhance the taste of meat or to obscure the advance of its deterioration.

In spite of the widespread adoption of fish canning on the Pacific Coast and some improvement in curing methods, a continuing interest was devoted to the possibility of marketing fresh[16] fish. This interest was intensified in North America by the growth of large cities and metropolitan areas in the interior and by the westward shift of population from the Atlantic Coast. In the United Kingdom, consumers could choose between fresh, canned or cured fish, but only the two latter forms were available in the growing cities of this continent. There appeared, therefore, to be a latent market for fishery products if they could be presented in a new or more acceptable form.

Like drying, freezing must have an ancient history as a natural preservative for fish and game. In northern Canada, for example, the Eskimo make use of natural temperatures to keep fish and seal flesh in frozen storage. There is only a limited land area, however, where the climate is consistently cold enough to support natural freezing on any significant scale. Nevertheless, the advantages of such a method must have occurred to a great many people and, towards the middle of the 19th century, serious experimentation was under way in Europe to remove heat by mechanical means.[17] The curing of fishery products and the canning of fish had been undertaken in their pioneering periods with little or no knowledge of the physical and chemical processes that were involved, and freezing went through the same experience.

Put simply, freezing is an extension of the preservation principle employed in icing, i.e. the slowing down of bacterial growth by lowering temperature. Other post-mortem changes are also involved, however, including autolysis and rancidity. Freezing time, temperature, and the exclusion of oxygen are critical factors in the development of these processes.[18] Their importance was not known in the early attempts at commercial freezing and poor results were quite common.[19]

Another prerequisite of quality, in frozen fish especially, is freshness in the raw product. Unfortunately, some plant operators utilized freezing to salvage fish in the last stages of deterioration and the resultant products reflected this condition. For one reason or another, a great deal of the early production of frozen fish ranged from poor quality to complete inedibility. Some curious practices appeared in the trade as freezing grew more general and "fresh" began to take on the meaning of "not frozen." Frozen fishery products were allowed to thaw prior to sale as fresh and, in some cases, fresh fish was frozen, held for long periods awaiting a seasonal upturn of the market, and then thawed and sold.

The result of this combination of scientific and technical ignorance with bad plant and marketing practices was to pin a very poor reputation on

frozen fish for many years. This reputation stood the freezing industry in poor stead during the years which followed when scientific and technological advances, along with better business practices, began to yield frozen fish of increasingly good quality, i.e. increasingly like freshly caught fish in taste, odour and appearance.[20]

The Differentiation of Products

The methods which have been adopted for the preservation of fish flesh provide the basis for the classification of fishery products into the four major forms, i.e. fresh, frozen, cured and canned. These major forms contain sub-forms which have sufficient individuality, from the standpoint of processing or marketing, to make them mutually exclusive within the parent group. Fish sticks, for example, have now become a distinct sub-form within the frozen class because processing has been extended beyond preservation into kitchen preparation.

Elsewhere in this report it is noted that 150 species of fish are exploited commercially in Canada. By custom and by law,[21] the identity of species is maintained throughout the course of processing and distribution. To the initiated, fish is not fish but cod, salmon, whitefish, etc. It is obvious, therefore, that a combination of 150 species with four methods of preparation could result in 600 separate products. This range is extended when the sub-forms are included in the arithmetic of combinations, and a very large number of possibilities occur if additional variants, e.g. flavourings and sauces, are taken into consideration.

In actual practice, the fishing and fish processing industries do not provide a range of products that approaches in number that suggested by the mathematical possibilities. The number of distinguishable products is striking, however, especially in view of the relative size of the trade if it is measured, for example, against the Gross National Product.[22] A recent statistical report on the fishing industry[23] lists about 400 products, and many small items are included in "all other" groupings. The annual trade reports list 135 categories for fishery products exported, of which 14 are n.o.p. groupings.[24] As would be expected, imported fish complements domestic supplies by providing consumers with species not taken in large quantities in Canadian waters, e.g. shrimp, and with specialties canned in European countries. All canned fish is subject to inspection when it enters Canada for consumption, and inspection records reveal that at least 75 canned products are imported — from a large number of countries.

A high degree of differentiation is associated with other primary industries but the structure of the business organization that produces this differentiation differs from that in the fishing industry. While Prairie wheat is initially differentiated by variety and grade, the first processing operation takes place at mills far removed from the growing areas and the final processing into bakery and other products takes place in industries still further

removed both in distance and in structure. Bread and cake sold in Montreal originate in or around that city and not in Saskatchewan. Fish processing, however, is carried on in close organic and spatial relationship to fish catching and the integration of processing with catching, at least to some degree, is the rule rather than the exception. This integration, with minor variations, extends across the whole spectrum of the industry from the family business in Newfoundland producing one product to the corporations which utilize all the processing methods and offer 50 or 60 different products for sale. The fishing industry as a whole provides few examples of sub-industries restricted solely to raw material production on the one hand or processing on the other. The nearest approach, perhaps, is in the case of the species which are marketed as caught—lobsters, oysters, smelts and freshwater fish. Even in these cases, however, the distinction is not consistent, since part of the capital stock used by some fishermen is customarily given or rented to them by buyers in their attempts to secure supplies.[25]

The implications of this differentiation of products in relation to capital, labour and management requirements are discussed elsewhere. For the purposes of this section, however, it presents special problems in analysis and the development of generalizations. The only consistent common denominator of the 400 or 500 products of the Canadian fishing industry is their aquatic origin. Once removed from this environment, the differentiating process begins and extends to the personal tastes of consumers in the 50 or more countries to which the products are exported.

The market complex which has been built up in the 400 years' exploitation of Canada's fishery resources is illustrated, but only partially, by the export data recapitulated below:

Principal Foreign Markets for Canadian Fishery Products and Number of Such Products Exported to Each 1955

Market	Number of products[24]	Market	Number of products[24]
United States	106	Trinidad and Tobago	5
United Kingdom	10	Leeward and Windward Islands	4
Belgium and Luxembourg	6	Cuba	3
France	4	Dominican Republic	7
Italy	6	Haiti	5
Netherlands	8	Puerto Rico	7
Portugal	3	Venezuela	3
Spain	3	Hong Kong	2
British Guiana	3	New Zealand	5
Barbados	2	Australia	4
Jamaica	6	Union of South Africa	4

4

MARKETING AND PRICES

Primary Markets

The subject of the specific arrangements under which fish is sold by primary producers is approached with some trepidation owing, on the one hand, to the lack of organized information about the many markets that fishermen utilize and, on the other, to the ambiguity attached to the term "market" in general usage. In one context it means a country, in another the price level for a particular commodity or group of commodities. Primary markets do exist in which sellers meet buyers, where prices are agreed upon and where agreements of sale result in the transfer of fish but, across the entire industry, this process assumes many forms and in some cases it is extremely difficult to discern how it actually works.

One characteristic that runs through most of these primary markets, however, is a general acceptance of the "season price." This is, apparently, a traditional adaptation to a complex of factors operative throughout the industry. In Newfoundland the price for salted codfish is often fixed before any fish are caught.[1] Records are available for many years of meetings, arranged under one sponsorship or another, at which the annual price was set, but these do not give any clear indication of the mechanism that produced it. During the more recent period of "export groups" and the Newfoundland Association of Fish Exporters Limited (NAFEL), the buyers obviously have had access in bargaining operations to an extensive market intelligence service lacking to the fishermen and which the latter probably could not have utilized in any event.

The salmon fishermen of British Columbia have also sold their production on the basis of a minimum seasonal price for many years, but their bargaining position has differed from that of Atlantic Coast fishermen in the degree to which they have presented a united front to buyers, in the knowledge which their leaders have had of market factors and in the weapons which they have used to reinforce negotiation.[2] After prices and other terms have been negotiated, market conditions may result in higher prices but not in lower ones.

Those two cases are not presented for invidious comparison but to illustrate the variation in basic characteristics which occurs in each phase of the industry. On the Atlantic Coast another example of such variation appears in the use of two prices—a winter price and a summer price—for raw fish in the fresh and frozen trade. A premium up to one cent per pound is offered as an inducement for winter fishing, to offset the greater hardships and larger uncertainties associated with this season (in the interest of greater stability in seasonal supply).

There is a tendency for fishermen everywhere to sell regularly to one buyer, and plant operators characteristically refer to "my fishermen." This association continues to be apparent with fishermen who move from one fishery to another or from port to port. To some extent, plant competition for fish is actually competition for fishermen, and price is not the only consideration entering into purchase and sale agreements. Others may be the provision of credit to fishermen for supplies, gear or even boats, the use of plant facilities to store bait or baited trawls and the supply of bait, ice, water and petroleum at the site where the fish is sold.

In the northern lake fisheries, the buyer customarily arranges for the outfitting of fishermen each year. Food, nets, fuel and boats are found by the buyers, and the catch, year in and year out, must pay for this equipment as well as the labour of the fishermen. In addition, the buyer has to arrange for the transportation of the fish by plane, snowmobile or truck to railhead. Within this system of marketing, the prices received by fishermen are a matter of direct concern to the buyer not only because of their function in regulating supply but also because of his investment in the primary fishing operation. The actual nature of the market which determines prices at the lakes is not well known. The preponderance of freshwater fish is bought by importers in Chicago, Detroit and other midwest points who form a distinguishable fish trade. A considerable variation in wholesale prices occurs from day to day, which suggests a certain degree of sensitivity to some factor in the marketing situation, and the mechanism of adjustment would appear to be based upon a considerable volume of trade intelligence passed by telephone or telegram among individuals.[3] To what extent these market fluctuations are passed on to the primary producer is not known with any degree of precision but it would appear that some price stability is common at the lakes, although not to the degree that is exhibited by prices of sea fish.

When fishermen speak of price, then, they are generally referring not to a current price but to one which they expect will continue throughout the particular season. To some extent this attitude probably reflects the traditional view of the way prices should act. The knowledge that the price for fish will not vary from week to week or month to month reduces one of the many uncertainties that beset each fisherman. He cannot be sure whether there will be fish when he sets his lines and he cannot be sure

today that tomorrow's weather will allow him to fish. Natural conditions can influence his productivity severely and a rapidly fluctuating price might add substantially to the variability in his returns. A relatively stable season price has the virtue, in his eyes, of providing one fixed factor in the group of unknowns that he faces.

It would also appear that fishermen, along with other primary producers, are suspicious of a mechanism that brings sudden and abrupt changes in the price of their products. Well organized auction markets have been developed at Boston and Gloucester, and for halibut in Vancouver. It has been reported in the United States press from time to time that New England fishermen are dissatisfied with the system of auctioning groundfish, and in British Columbia the fishermen's union is seeking a season price for halibut that would be set in annual negotiations.

Where the price to fishermen is not set by negotiation, there is probably a considerable amount of leadership in the price making process. It is demonstrated elsewhere[4] that a frequency distribution by size of fish processing establishments—the first buyers for most fish—shows considerable concentration of production in a relatively small proportion of all establishments. Those are the firms or corporations with well developed specialization at the managerial level, including specialization in market assessment. This function is of particular importance when the raw product for plant operation is bought from fishermen on a season-price basis. Information about prices spreads quickly through fishing communities and the speed of transmission in recent years has been increased by the widespread installation of the radio-telephone on fishing vessels.[5]. When a plant manager tells a fisherman the price his firm is paying, the result is the same as if the price had been published in the daily news or announced over the air. Under these conditions, price leadership may be a natural development in the absence of organized markets of the exchange or auction type.

A third type of market is associated with certain species like lobsters, swordfish, clams, some freshwater species and Atlantic salmon. In general the marketed "form" requires a minimum of processing and the products move quickly from the fishermen to the markets. Stocks do not level out supplies or contribute to price stability as they do in the canned, frozen and salted forms. Prices show wide and rapid fluctuations throughout the season and are, apparently, quite sensitive to short-run changes in the supply position. In some cases, there is a pronounced seasonal variation in prices which is apparent year in and year out.

Atlantic lobsters sold for the shell trade are a particularly relevant example of a species sold in this type of market. The total supply is limited by conservation measures both in Canada and the United States and there is a marked seasonal pattern in production and available supply, with prices reacting quickly to the day-to-day supply position as well as to longer-run changes over the season as a whole. To some extent, this price sensitivity

is brought about by the direct contact that often exists between buyers from the principal markets and individual fishermen or groups of fishermen, with a consequent acceleration in the communication of market intelligence. Market news, whether carried in newspapers, over the radio or otherwise, is widely disseminated and becomes a substantial factor in the bargaining position of the fishermen. The significant characteristic of this type of market, however, probably lies in the nature of the main products associated with these species, i.e. their relatively short shelf-life and the necessity for their rapid movement into consumption. Marketing is largely a matter of assembly and distribution, with processing and storage reduced to a minimum.

Organization for Processing and Sale

The products of the Canadian fishing industry today reflect the history of fish catching and processing from the beginning. Within the limitations set by the appearance or disappearance of some species, all of the methods, processes and products of the past are now represented in the output of the industry. It is not surprising, therefore, that some part of the business organization should also exhibit the same linkage with the past. At the same time, it contains elements which represent the most modern trends in business management and merchandising.

National gatherings of industry and trade representatives display an amalgamation of terminologies bridging the years from 1500 to the present. The shades of 16th century fishmongers would be at home in discussions of quintals, butts, drafts and green fish. The hucksters of this century would be equally at ease in conversations about impulse buying, eye appeal and consumer franchise.

This congeries of products, customs and terminologies is reflected in the business organization from coast to coast and practically denies the use of generalities in description or analysis. It does not simplify matters much to break the industry down into either regional or specific trade groups, because the new divisions contain as much diversification, relatively, as did the total.

The complex structure that now exists is the answer, in terms of business organization, to the demands of consumers diversified by race, geography, earning power, religion, habit, acquired and discarded tastes and a host of other factors. Over 65% of the consumption of Canadian fishery products takes place outside the country, much of it in areas where objective measurements of basic factors—population, production, trade—are either limited or lacking altogether. Few examinations have been made into the factors which influence consumption,[6] except in a very general way, and it cannot be presumed that the importance of the fisheries in the

national economy will ever justify the expenditure needed to throw light on even the larger questions in this field.

Through the years, business organization has dealt with the problem by empirical means and with a rate of adaptation that is, perhaps, commensurate with the risks that have been associated with this industry. Some of these risks are unique, or perhaps it is more accurate to say that the sum of the risks is unique. Practically the whole of the supply of raw material is a common-property resource; many of the basic products have been developed to meet special needs which have been short-lived; and the trade in general has had an export base. Each one of these characteristics has involved the industry in international disputes, governmental arbitration and governmental trade policies.[7]

In some countries, and at one time perhaps in Canada, the distribution of fishery products was carried out entirely by a recognized fish trade. Distribution was restricted to three levels: delivery at the port, assembly at the market and retail purchase. This same system is preserved today in Canadian coastal towns and cities where fishermen's wharves may provide a direct contact between the fishermen and consumers.

Distance and the westward migration, however, quickly imposed limits to this type of distribution and a differentiation of function began. In this process it must be supposed that the distribution of fishery products flowed along the channels marked out by agricultural foods. When the butcher shop was the outlet for meat it also handled fish. Where cooler space was available for meat and dairy products it could be used for fish (with some exceptions). As markets widened, the role of the broker, wholesaler and retailer became associated with fishery products and specialization in the distribution of some species, e.g. oysters and lobsters, appeared. At the same time, however, a movement away from specialization took place with the advent of canning on both coasts. The shelf-life imparted by canning is so long that the product is not subject to deterioration under ordinary commercial conditions. It is a dry product, as opposed to meat and iced fish, and this characteristic, along with uniformity in package, has always been associated with the grocery trade. Canned fish has now become a grocery item and as such divests itself of association with the parent trade once it is sold by the packer.[8]

The "consumer coverage" of canned fish is as extensive as that of any food product sold in this country and it is distributed domestically through the grocery trade. The export trade in canned fish, however, is generally restricted to the canning companies where internal specialization very often includes an export division. So far as is known, foreign selling is conducted entirely through nationals in the various markets who act as agents. There is no direct company penetration into the markets by Canadian representatives except, perhaps, where special circumstances have necessitated personal exploration of markets.[9]

If the canning industry has the greatest coverage of the Canadian market, curing has the least. With minor exceptions, it is, of course, an export industry and has been concerned with the consumers in Mediterranean and Caribbean countries rather than those in Canada. At the present moment, the salted cod sector — which is by far the most important one — seems to be poised on the brink of substantial changes in production techniques and product adaptation. If this development takes place it may well be followed by a reorientation of distribution methods. At the present time, however, distribution bears the clear imprint of the so-called merchant system — especially in Newfoundland. An earlier warning was posted in this section against the dangers of generalization in this field, and exceptions to the prior statement have to be recorded. In Nova Scotia the system was undermined when the operations of the fish "makers", who undertook the drying of the green salted fish produced by shore fishermen and bankers,[10] were taken over by plants utilizing mechanical drying in the late 1930's.

Mechanical drying entails fairly substantial capital outlays for plant and equipment and has so far been adopted only by a few firms with long histories in the export trade in salted fish. For the last 15 years several of these companies have been manufacturers as well as exporters. The typical firm is a family enterprise in which all of the modern departments of management are the responsibility of one or two persons.[11] Export business is developed by the use of agents in the foreign markets who may specialize in fishery products or handle a wide range of food products. The principals depend upon their agents for intelligence on matters which foreshadow changes in the market, including the activities of competitors, as well as the actual sale of goods in the country. In some cases the same agent acts for more than one principal in the salt fish business, including those in other countries like Norway and France, for example.

In Newfoundland the salt fish trade has been organized for centuries according to the system mentioned above. The merchants in the outports are the first buyers of the fishermen's production, and the suppliers of their living and fishing requirements. In some cases they are principals in the trade, but more often they have some connection with a commercial house in St. John's. Company and bank resources flow from the city to the outports to finance outfitting at the beginning of the season and the purchase of the fishermen's production at the end of the season.[12]

This credit system has been of substantial importance to the fishermen of Newfoundland because of the absence of normal credit facilities in the outports and the long period which elapses between the preparation and the final sale of salted fish. Reference was made earlier to the trap fishery and the concentration of processing into a very short season. Fish that is dry and ready for sale in October may not be exported and paid for until May or June of the following year. The stocks held during this period must

be financed, and the merchants have traditionally performed this function in addition to financing supplies.

During the late 1930's, the merchants developed export groups based upon a traditional interest in specific markets.[13] The purpose of this development was to reduce internal competition among Newfoundland exporters and to build up greater bargaining strength in opposition to the growing penetration of governments abroad into the fishing business. National policies designed to develop domestic industries, to decrease food costs or to control exchange rates were common in this period and added to the difficulties generally experienced as the result of a continually weakening demand for most products, including salted fish.

In World War II, the allies established joint allocation of food through the Combined Food Board, and salted fish from Newfoundland and from the Atlantic Provinces of Canada was included in the commodities within the purview of the Board's activities. While allocations were in effect, commerce in food was carried on under conditions of restricted supplies and active demand, and salted fish prices advanced steadily until 1947. In Newfoundland, as elsewhere, there was considerable uncertainty about the conditions that could be expected after hostilities ended. With the difficulties of the '30's in mind the export-group approach was carried further and an export association (NAFEL) was set up to handle all the salted codfish produced in Newfoundland.[14]

Sales were made on behalf of the Association from an office in St. John's which maintained its own agents in the principal markets. Originally, the Association was made up of 34 exporters who purchased processed fish from fishermen and culled and stored it against the forwarding advice of the selling management. As a sales agency, the Association was precluded by law from buying fish from fishermen, from influencing the price paid to fishermen and from other activities affecting the primary producer.[15]

The selling monopoly was complemented by the development of import groups in the principal Caribbean markets.[16] While there are advantages in this type of organization, from the narrow viewpoint of the control of competition, they must be predicated upon static conditions both in production and trade. For example, the allocation system is used in dividing up both exports and imports and the apportioning of shares can only be carried out satisfactorily under *status quo* conditions. While the trade in salted fish has a strong traditional character, it is still subject to changes, some quite abrupt, in the factors influencing both supply and demand and such changes put severe strains upon any arrangement to limit competition.[17]

The exclusive right to export gave the Association control over some 25% of world trade in salted fish (*circa* 1950). In the Caribbean markets, where the Newfoundland trade had achieved a dominant position, the proportion was substantially higher. Part of the rationale for the monopoly had been the expectation of price stability and the maximization of returns

to Newfoundland fishermen. This theory did not stand the test of competition, declining demand and falling prices in the postwar period. The assistance of the Fisheries Prices Support Board had to be invoked on behalf of the fishermen in 1949, 1950 and 1953.[18].

Whether the sequence of events from 1949 to 1953 would have been different in the absence of a sales monopoly in Newfoundland is impossible to judge, and only conjecture supports the argument that it prevented conditions from becoming worse. As a stabilizing agency, however, the Association is weakened by the organization which supplies the goods it sells. The season price, established for fishermen when fishing begins, the uncertainty as to the volume of production and the protracted marketing period combine to make the trade highly speculative. The considerable financing which is required for both fish and supplies causes continuous concern throughout the season about the course of prices and the volume moving. The rate of sales is carefully followed because of the danger of losses from the deterioration of unsold stocks.[19] It is generally agreed that Newfoundland salted fish changes in character during prolonged storage, and the "downgrading" which results brings about a lower average return from the markets. This, in turn, reduces the margin between the merchants' returns and the amounts they have advanced to fishermen. In addition, the prospect of slow sales raises the question of increasing credit cost, and a company with a weak liquid position tends to press for sales to protect working capital. In an association of this kind the weakest-link principle tends to apply, and goods are likely to be sacrificed—from the price point of view — in the interests of stock liquidation. To some extent, this attitude is reflected in the generally held opinion that the worst possible marketing development is to lose consumption, i.e. to experience a break in the regular flow of exports.

The deterioration which occurs in salted fish stored in Newfoundland is accelerated by the widespread use of common storage. In other areas cold storage is used for two purposes: to conserve quality and to control supplies in the interest of price stability.[20] Common storage, however, depends entirely upon natural factors — and the care taken by fishermen in splitting, salting and drying their fish. Poor weather in the normal drying season affects the quality of the product and, if it continues for a lengthy period, there may be a general decline in average grade. Under these conditions therefore, the value of the entire production may be reduced by a determinant not related to the behaviour of the market.[21]

Turning to the fresh and frozen trade, it can be said that a complete description of the business organization in this field would require a separate volume and much more organized knowledge than is now available. The number of establishments engaged in the processing of fresh and frozen fish is much larger than in the curing and canning branches of the industry, and there is a wide range in the size of the units.[22] The preparation of fresh

and frozen fish is sometimes carried on in conjunction with canning and/or curing and there are many combinations of these processes within a single enterprise.[20]

In spite of the modernization that has taken place in this sector of the industry, a large number of very small establishments have persisted as independent operations, especially in the purchase and sale of fresh fish in Nova Scotia and New Brunswick. The freezing operation requires much more capital in plant and equipment and presents greater problems in technical management than does the handling of fresh fish. Freezing, therefore, has tended to be concentrated in larger establishments with specialization of management in separate divisions for production, sales and cost and audit.

Fresh and frozen fishery products are assembled or processed by plants in all of the ten provinces for sale in Canada and the United States. There is a considerable degree of penetration by American interests into the production phase in Canada, as well as Canadian penetration into the United States through sales agencies or subsidiaries. In the freshwater fisheries a complex form of organization is based upon the active interest of U.S. importers in supplies of freshwater fish like trout, whitefish and pickerel (pike-perch). Financing from these companies pushes out to the most remote lakes where fishermen are outfitted with grub, gear and boats under many types of agreement.

It is probably reasonable to suggest that the fresh and frozen trade includes, throughout its entire range, some examples of all the forms of business organization to be found in North America today. Some sectors are typically organized on a fish-trade basis, with processing and distribution, whether domestic or export, carried on by firms solely concerned with fishery products and with specialization appearing at all levels: processing, wholesaling and retailing. Certain species, e.g. oysters, form the basis for a trade which is quite distinctly set off from the whole fish trade as such and from the food industry generally.

The high degree of differentiation of product in the fishing industry, noted earlier, is paralleled by the variety of business forms which have grown up with, or have become adapted to, these forms of production. There is, of course, a substantial concentration of production in the large firms[21] but the persistence over the years of a great number of small plants has obvious implications for the cost structure of the entire industry and for market stability.

Some Characteristics of Primary Prices

Associated with the three general types of primary sales organizations are characteristic prices which can be categorized as negotiated, leadership and market. Negotiated prices exhibit a seasonal stability by definition, so

to speak; leadership prices show a similar stability arising from the nature of the operations associated with processing, storing and multi-purpose use in the production of various forms; and market prices behave as the term suggests.[25]

While the prices in these groups have one common characteristic, the groups are by no means homogeneous. Fish prices exhibit the same tendency towards differentiation that is found in all other aspects of the industry. The first group, for example, includes prices for British Columbia raw salmon for canning and prices for Newfoundland salted cod, because each of these is determined by annual negotiation. However, it has already been pointed out that the bargaining strength of the two groups of fishermen involved is quite dissimilar and, presumably, this condition is reflected to some degree in the prices that they achieve by bargaining. British Columbia prices, in addition, are only a part of a larger contract which covers many aspects of fishing operations: contributions to a welfare fund, gutting allowances, minimum crew numbers, certain travelling expenses, etc. Presumably management has to aggregate all of the terms and conditions of such a contract in considering what prices they can agree to, whereas the Newfoundland price is unqualified by any consideration other than grades. Local transportation differentials apply in both cases.

An additional qualification arises from the operations of firms which both catch and process fish—a combination which is fairly common in the British Columbia salmon and herring fisheries, in fisheries for the fresh and frozen trade of the Atlantic Coast and in the salt-banking operations out of Nova Scotia. From the point of view of the company, payment for fish landed by a company owned vessel represents an intra-firm accounting device in which the cost to the processing division is the price to the fleet division. As far as the crew is concerned, however, settlement for the catch is not thereby affected and the proceeds of the voyage are generally calculated on the basis of the season-price which is known to all those involved in, or interested in, this particular industry. The division of the proceeds, or gross stock, is made according to a complicated lay arrangement under which certain expenses are deducted from the gross stock; the balance is then divided into boat and crew shares and the latter into individual crew shares, depending upon status.[26] In such arrangements, the settlement price is an important factor, but it is not a price which can be compared without qualification to that paid to independent fishermen using their own equipment for fish they deliver to the plant.

A somewhat similar situation obtains in the pricing system of the northern lakes. It has already been noted that the fishermen in these areas—generally north of latitude 55°—are financed by the buyers and that in some cases this financing extends back to the large importers in the central U.S. markets. In these circumstances, the repayment of the seasonal debt depends upon the catch and the price which it brings. There is often

keen competition among buyers for the particular species caught in these areas and this competition works itself out in efforts by purchasers to attract and hold fishermen as suppliers. From time to time, prices are paid at the lakes which do not reflect the actual returns from the current market but are an attempt to wipe out or reduce the season's indebtedness if the going price is not sufficiently high. Thus, at any given moment, current lake prices may vary considerably, one way or the other, from the theoretical price that regulates supply. Prices over a season or a period of seasons, however, are equated to supply and demand conditions—for obvious reasons.

A further word of qualification is necessary with respect to prices paid to fishermen for Atlantic groundfish, because the species are processed into several forms.[27] Many processing firms combine these operations. Cod, for example, is sold in the following forms: a) dressed and filleted, fresh, b) dressed and filleted, frozen and c) filleted, smoked. Each of these forms has a specific market value and all differ from one another in costs and returns. In general, however, except in Newfoundland, the same price is paid to fishermen irrespective of the final utilization and this practice prevents any unqualified comparisons of raw and finished product prices (Fig. 1).[28]

There is a widespread tendency for fish prices to be quoted in cents per pound, and these quotations are used in the industry from St. John's to Vancouver when fishermen sell raw fish. There is some variation in the case of products processed by the fishermen: pickled mackerel and herring, for example, are sold on the basis of dollars per barrel and in Newfoundland dried codfish is sold by the fishermen on a dollars-per-quintal (112 lb.) basis and saltbulk on a dollars-per-draft (224 lb.) basis. Herring caught in British Columbia is sold by the ton, perhaps because the main product (fish meal) is sold on the same weight basis.[29]

If both parties involved in a purchase and sale agreement understand the terms, the price basis is not important and, except for the irritation that is subsequently provided for statisticians, the variation in units is of no great moment. In this day and age, however, prices quoted in cents not only seem incongruous but they preclude any fine adjustments to market factors. The smallest interval normally employed is one-quarter of a cent and prices vary by multiples of this. If a species is currently selling at 20 cents, a quarter cent interval allows a variation of 1.25%. On the other hand if the current price is one cent per lb., which is not unusual for certain species on the Atlantic Coast, an increase or decrease of a quarter of a cent is a change of 25%. It is probable that circumstances of this kind contribute substantially to the inertia of fish prices at the primary industry level.

In effect, the cent-per-pound basis suggests that fairly substantial changes have to take place in demand or supply factors before there

is a commensurate change in primary fish prices. In actual practice, it would appear that buyers normally accept short-run periods of profits and losses, on weekly operations, in order to preserve the stability of the season price. In the Report of the Royal Commission referred to earlier, the following statement appears:

> Groundfish marketed in Montreal and Toronto is usually handled by a wholesaler or jobber before it reaches the retailer. In practice the shippers at the coast, every Thursday, either direct or through their agents in Montreal and Toronto, quote prices at which they will deliver groundfish the following week, either f.o.b. at the coast or at these markets. Almost without exception the wholesalers in the markets of Quebec and Ontario expressed to us their preference for a stabilized price at the coast of from 5 to 7 cents per pound, instead of the lower and widely fluctuating price prevalent at times during the past few years. A fall in the wholesale price is not apparently shared in by the consumer, and the tendency is for the retailer to maintain the higher level of prices to provide for possible losses. It is also said that fluctuating retail prices are regarded with some suspicion by consumers. There is, therefore, the anomalous situation of the retailer and wholesaler both preferring a steady and higher level of prices, yielding a greater return to both fishermen and shippers, while the shippers frequently lower the price in unprofitable competition with each other without any advantage to the consumer.

In the previous paragraphs it was pointed out that raw fish is generally sold by fishermen in cents per pound and the suggestion may have been left that a pound of fish is an invariant thing but this, of course, is not the case. Fish is delivered to buyers in the following caterogies:

1. Round	—	the fish as it comes from the water.
2. Gutted, head-on	—	the entrails removed; in summer gills are sometimes also removed.
3. Gutted, head-off	—	entrails and head removed.
4. Split	—	stage 3. Carried forward by removal of two-thirds of the backbone.
5. Filleted	—	this operation is not often carried out by fishermen; it involves a separation, by cutting, of the two lateral pieces of flesh from the body; the backbone and ribs form an obtuse angle, with the muscle lying between—hence "fillet".

The significance of these various forms to the buyer is the sum of several variables: a) the weight of the products purchased, b) the subsequent yield, c) the cost of cutting to be done after purchase, d) the value of the offal for by-product purposes and e) market requirements. The price for any particular form, therefore, must embody consideration of all of these factors. While there is a general association between some species

and the form in which they are first bought, the association is by no means invariable. Halibut and swordfish on the Atlantic Coast are bought gutted and headed, for example. These are large fish and the ratio of edible weight to head and gut weight is high. Prices are relatively high and the practical method of utilizing capital and labour most effectively, and of controlling deterioration, is to get rid of the head and guts as quickly as possible, i.e. by dressing at sea.

The various forms in which fish are landed have a long history of development, and a particular form represents an adaptation to several factors, e.g. inhibition of bacterial decomposition, economy of transportation and market requirements. Gutting at sea, as a general process, has several advantages: a) it contributes to a full use of labour on the vessel, b) it increases the size of the pay load the vessel can carry back from the grounds, c) it reduces the danger of autolytic degeneration and d) it obtains a higher price from the buyer because of the labour content in the product. But this particular practice is not characteristic of the entire industry. Redfish and the smaller flatfish are landed in the round, because of the difficulties they present in cutting at sea, and in a few instances are shipped to market in this form.[30] There is a continuing demand for round or dressed, i.e. gutted, fish, which originates largely with the restaurant trade. The price realized is sufficiently large to offset the considerable cost involved in transporting the inedible portion, perhaps 50% by weight.

While a considerable quantity of information is available on fish prices, a complete coverage has not been established for all species as landed nor for all forms at the plant and at wholesale and retail levels. The large number of species and forms has already been referred to and the problem associated with complete statistical coverage is indicated by these data. There are several considerations which have led to the selection of the prices which are now collected and, in some cases, these have outweighed the principles of statistical consistency. At the primary level, it has been necessary to obtain prices paid to fishermen on the Atlantic Coast at several representative ports, e.g. Halifax, Lunenburg, Souris, Caraquet and St. John's. Some ports are landing points for only one or two species but they must be included to provide statistical coverage for those particular species. The result of all these considerations is a somewhat unwieldy agglomeration of price series that are difficult to deal with as aggregates.

In general, prices are not available at the plant, i.e. manufactured, level except as they are reflected in the marketed-value data gathered by the Dominion Bureau of Statistics in the annual census of industry.[31] Unit values derived from quantities and values marketed are comparable with unit export values—that is, the declared export values divided by the quantities exported.[32] To complete the price series, the D.B.S. collects and publishes data on wholesale and retail prices for specified products in several Canadian cities.[33] These prices are averages of price quotations

taken one day a month and, because they are averages, rarely conform to the actual price in a given store in a given community. Over time, however, they reflect price trends quite well.

All fish prices—whether to fishermen, at plant, wholesale or retail—are strongly influenced by conditions outside this country. With the possible exception of oysters, it is impossible to find in the whole range a single price which could be considered the result solely of Canadian factors, i.e. one for which the factors of supply, demand and competition can be described in terms of conditions within this country. There is a group of products—those in the fresh and frozen forms—consumed solely in North America and, in this case, U.S. demand is the dominant factor because of the strong orientation of many processing firms to this volume outlet. To some extent, therefore, prices for these commodities in Canada are influenced by U.S. prices, which thus become a factor in the price paid to Canadian fishermen for raw fish.

At the other end of the range is a group of fishery products for which the price in Canada is the concern of fishermen and processors only, because the products are not consumed to any appreciable extent in this country. Salted cod, pickled herring and mackerel and bloaters are examples of this group. For these products, prices are largely influenced by the level of demand in a great many foreign countries—notably those in the Mediterranean and Caribbean areas—and by the production of, and competition from, the fisheries of Iceland, Norway, France and other countries.

Because prices of fishery products are such a "mixed bag" in terms of casual relationships, they cannot be described or analyzed except in relation to the unique set of supply and demand factors associated with each of them. By the same token, any aggregation of prices — an index of all fish prices is an example—has to be used cautiously to avoid attaching to it a significance suggested by facility rather than reality.

Relative Prices at the Primary Level

As the controller of resource exploitation, prices may appear to operate without a high degree of precision in the fishing industry. While there has been a movement of men away from fishing, especially on the Atlantic Coast, this movement has not been as large as the relative price situation would appear to warrant in one or two of the fisheries of this country. The explanation is fairly well known: in some areas fishermen stay in the industry because there are no alternative occupations that do not involve leaving home and severing family ties.[84]

Species	Index of Prices to Fishermen, 1954 1935 - 39 = 100
Herring, B.C.	525.0
Salmon, B.C.	398.2
Salmon, M & Q	342.8
Lobsters	327.7
Mackerel	309.3
Pickerel (yellow)	283.6
Halibut, M & Q	264.1
Cod	250.0
Haddock	247.6
Whitefish	232.7
Herring, M & Q	225.0
(Index of general wholesale prices, Canada)	(217.0)
Flatfish, M & Q	212.4
Halibut, B.C.	210.1
Lingcod	153.3
Lake Trout	140.4

The course of fish prices prior to the above year was a striking feature of the industry, especially in view of the nature of some important sectors which have not been particularly noted for adaptation to modern conditions. Fish prices received a substantial upward acceleration during the war years and in the postwar period when the world food shortage was acute. The acceleration continued almost without interruption until 1952, when the decline in all prices had its effect on fish prices.

This index comparison does not, of course, provide for a comparison of the relative price position of the various species of fish. It is well known that some species are more valuable than others, on a price basis, not only in terms of returns to fishermen but also in terms of the prices which the products prepared from them command in the markets. The raw fish price paid to fishermen is eventually translated, by the market mechanism, into a price to consumers for the products which they buy. Presumably the edible weight of the product at this level is one of the considerations in the setting of the retail price and, eventually, the price to fishermen. The various forms as landed vary rather widely in the proportion of the edible weight which each provides and, in the table which follows, the basis for the average price paid to fishermen over the past few years has been converted to the edible weight equivalent in order to permit a comparison of the relative value of one "edible" pound of each one of the important species.

Species	Average Price as Landed[39] (cents per lb.)	Equivalent Price, Edible Weight (cents per lb.)
Lobster, Nova Scotia	35.0	148.8
Lobster, M & Q	30.6	130.0
Salmon, M & Q	38.3	57.4
Lake Trout, all provinces	16.4	39.4
Whitefish, all provinces	16.8	37.0
Salmon (sockeye)	22.4	33.6
Salmon (coho)	17.2	25.8
Halibut, B.C.	16.1	24.2
Lingcod, B.C.	7.7	17.8
Flatfish, B.C.	5.1	16.6
Salmon (pink)	8.0	12.0
Haddock, M & Q	4.4	11.7
Flatfish, M & Q	3.0	11.2
Cod, Nova Scotia	3.4	9.0
Mackerel, Nova Scotia	3.7	7.4
Cod, Newfoundland	2.2	5.8
Herring, M & Q	1.0	2.0

The introduction of regional price differentials in the case of lobster and cod is necessary to illustrate the effect upon prices to fishermen of differentiation at the product level. Nova Scotia lobsters are marketed largely in the shell and the combination of better price and larger size brings a higher average return to fishermen than is the case when the average is computed for all lobsters landed in the Maritimes and Quebec. The latter price is heavily weighted by returns for "canner" lobsters, which are smaller and less valuable. A similar condition applies to cod prices. In Newfoundland the average landed value of all cod is heavily weighted by the returns from the salted product but in Nova Scotia the same price is paid for cod whether it is used for the production of salted cod or, for example, fillets.

The range of value among the several species, from low to high, is from 1 to 75 and suggests the presence of substantial differences in the supply, demand or other factors which bring such a variation about. Reference to the previous table suggests for some species a relationship between value and long-run purchasing power, with the most valuable species having had the best relative price experience in the last 30 years. Fishermen who concentrate on these species have a twofold advantage, from the point of view of comparative prices alone, over those whose income is tied to other species.

There are inconsistencies in the position of some species in the two tables. The most glaring one is lake trout, which is the third most valuable species but has apparently experienced the worst relative price trend. The situation is explained in part by the predation of the sea lamprey, which has damaged the stocks of this species to the point where commercial landings in Lakes Ontario and Huron have practically ceased. The drop

in supply has been largely offset in recent years by the exploitation of stocks in the northern lakes. Fishing operations on the new lakes, however, involve large transportation costs, resulting in lower returns to the fishermen. The average marketed value of this species rose from 24 cents a pound in 1945 to 30 cents in 1954 but the average landed value fell from 20 cents to 15 cents in the same period. The apparent decline in the price to fishermen, therefore, is actually the result of an increase in distribution costs associated with more remote production.[40]

The relative position of British Columbia halibut in the two tables is also worthy of note. The rehabilitation of the Pacific stocks, under the aegis of the Halibut Commission, began to result in larger landings, by both Canadian and American fishermen, about 1947. The increased supplies over the ensuing years, and the particular method of marketing the bulk of landings in the frozen form, was accompanied by a stable price from 1947 until the market break in the 1955 season.

British Columbia herring present a special case. The value attached to the fish as landed comes from a non-food use, i.e. the production of fish meal for animal feeding, and the price to fishermen for this species is lower than any shown in the preceding table. The index of herring prices in 1954 was higher than that for any species included in the table and this situation is a direct reflection of the price obtained for meal and the progress made in the application of technology to the herring meal industry over the preceding 20 years.

In considering the causes for the relative position of these species, when they are ranked by unit value, the possibility of supply as an important factor immediately suggests itself. In the table below, the ranking of species is repeated from the table on page 63 and average annual landings are added in order to allow a preliminary comparison between the relative values and supply.

Value Rank	Average Annual Landings[41] (million lb.)
1. Lobster	47.2
2. Salmon, Atlantic	3.7
3. Lake trout	6.1
4. Whitefish	25.3
5. Salmon (sockeye)	29.7
6. Salmon (coho)	22.2
7. Halibut, Pacific	21.5
8. Lingcod	4.5
9. Flatfish, Pacific	9.0
10. Salmon (pink)	51.1
11. Haddock	108.2
12. Flatfish, Atlantic	69.4
13. Cod	624.5
14. Mackerel	26.2
15. Herring, Atlantic	186.1
16. Herring, Pacific	323.1

In this table, the magnitude of the landings associated with each species does not indicate the size of the potential supply that could be caught if conservation principles were ignored. Certain species, for example, the salmons on both coasts, lobster, Pacific halibut and trout and whitefish from the Great Slave Lake, are subject to conservation management. These are the "high-priced" species and it would appear that there is a real connection between limited supply and unit value.[42]

Landings of this high-priced group of fishes are not taken from an inexhaustible source but from one which is limited by reproduction and growth rates and for which, in some cases, artificial restraints have been placed upon the annual crop. In this context, "supply" is not used in the sense of the variation, from month to month or season to season, that is usually associated with short-run price changes but, rather, in the sense of a long-term ceiling on the quantity that can be expected to move to the market in any particular season. To some extent, therefore, these different levels of price can be said to reflect the relatively scarce or abundant supply conditions associated with the species concerned.

The section of this report dealing with the resource base suggests that there is an unused potential supply of a number of species, notably cod and herring. For both of these species, the potential supply is not subject to the limitations associated with the higher priced species. The same supply considerations, however, do not apply to haddock and small flatfish—the two species that, next to cod, are most important in the groundfish group and that are used extensively in the filleting industry. Both of these are probably being exploited at, or close to, optimum levels and, if the preceding argument is valid, they should show some price reaction to this supply position. Prices of haddock do reflect their abundance relative to cod, with a landed value per pound generally one to one and a quarter cents above that of cod, i.e. a margin of 35% to 45%.

The fillets prepared from groundfish are probably not marked by any high degree of species differentiation at the market level. To the extent that this is the case, cod, haddock and flatfish fillets are substitutable and the cod potential may be a supplement to the supply of the other species either in terms of actual landings or as a prospective supply for the market. The prices of all of these species, therefore, probably reflect the supply potential of cod in addition to their own.[43] Cod, herring and mackerel make up the group of low-priced species which, as a group, are of basic importance in the fisheries of the Atlantic Coast provinces.

Prices of Fishery Products, 1935 to 1955

The prices paid to fishermen in the Canadian industry are reflected from the markets through a number of intermediate stages. On the domestic side, prices are established at retail, wholesale and plant levels in the case of processed items, and at the levels of retailer, wholesaler, broker or plant buyer in the case of oysters, lobsters, dressed fresh fish and other items that are largely unprocessed. For commodities exported, the retail, wholesale, broker and import prices are established in foreign countries and the first Canadian price is registered at the level of the exporter — who may be a processor as well.

The focal point for this variety of prices is the average annual marketed value, referred to in a previous section, which includes the raw fish cost of the particular product and the processing, assembling and selling costs. It is the first appearance of the product price, as against the raw fish price, in the scale of price levels. In the case of commodities resulting from processes carried out by fishermen, the export price, i.e., the average export unit value, is comparable with the average unit value, as marketed, of a plant product. If a product is sold on more than one market, the average marketed value is the weighted average of returns from the two or more markets, so that its use as an indicator of market prices considerably reduces the complexities of retail, wholesale, export and domestic quotations.

The movements of the prices of some fishery products are generally considered to be somewhat mysterious and not a matter of any great concern except to those directly engaged in the trade. The mystery is attributable in part to the complex array of definitions and qualifications that have to be attached to the whole range of fish prices and in part also to the relatively large number of products that have to be encompassed when dealing with this subject. Very little objective study has been devoted to the question of trends in raw fish prices and in the prices of fish products, or to the factors which bring about changes either in the short or the long run. Because of the lack of organized and detailed study, the tendency has been to explain price behaviour without any particular reference to the facts that are available. To the usual factors of supply and demand have been added the effects of taste, habit, religious customs, weather, presence or absence of bones, competition with meat, competition with other fishery items and a great many other things. Most of these factors should properly be characterized as demand considerations but, in ordinary discussion, such niceties are seldom observed.

One of the weaknesses in casual discussion of fishery prices is the general tendency to consider that "fish is fish" and to assume, unconsciously perhaps, that a similar set of factors affects all prices in the same way and to the same degree. It seems more likely, however, that

each major product, or each group of substitutable products, is characterized by unique supply and demand conditions that result in price behaviour that may vary, over reasonably long periods, from the behaviour of related prices. In the previous section it was suggested that the substantial differences among the prices of some species are associated with potential supply conditions. Supply alone, of course, is meaningless and somewhere there must exist a demand that translates supply into price. The probable existence of differentials in the demand levels for different fishery products is suggested by the following situation. During the week of May 30, 1956, Gaspé salmon was being offered at retail in Montreal for $1.25 per pound while frozen cod fillets were advertised at 29 cents a pound. Salmon could not be supplied to meet the demand at this price but the fillets moved slowly. The implication with respect to demand for these two products is substantial.[44] In this same connection no proof should be required for the statement that the demand for fish meal must be different from that for oysters or that the demand for oysters must be different from that for lake trout. As the differences in appearance, price and use diminish among the products, it is less easy to find *a priori* grounds for these distinctions and the possibility of substitution and price competition becomes stronger.[45]

Despite the individual differences in the supply and demand factors that have established the various price levels for the main products of the industry, the general course of all these prices has moved in a close relationship to those of disposable income and the general price level in Canada (Fig. 2).[46] The index of wholesale fishery product prices appears to have gained somewhat, relative to the general price index, from 1935 to 1955, but it did not quite keep pace with the trend in disposable income from 1952 onward. The behaviour of all prices in the post-Korean period was marked by a retreat from the high levels of 1951 and prices of fishery products followed the general trend downward from that year, but not to the extent experienced by agricultural products.

To some extent, the disparity in the last few years between the trend in disposable income and the general wholesale price index may represent the results of satisfaction of new or expanded wants in North America for things like television, new cars and travel. Growing incomes, under these conditions, may put less pressure upon the price level of what might be called traditional goods and services because these have been supplemented by a growing body of new ones. In what follows, however, the general wholesale price index is retained as the bench mark for comparative purposes, not only for trends in the prices for fishery products but also for comparisons among these prices (Figs. 3 to 5).

Again, there are sharp differences in the behaviour of the various products in their ability to retain—pricewise—their relationship to disposable income. These differences are summarized in the following table.

Product	Marketed Value Index, 1954 1935 - 39 = 100
Herring Meal, B.C.	393.2
Canned Salmon	341.0
Canned Crabs	332.8
Yellow Pickerel (dressed)	321.3
Salmon (dressed), M & Q	306.0
Lobsters (in shell)	267.2
Lake trout (dressed)	265.4
Whitefish (dressed)	263.8
Halibut (dressed)	259.3
Lingcod (filleted)	241.1
Cod (filleted)	238.8
Flatfish (filleted), M & Q	231.9
(Index of General Wholesale Prices)	(217.0)
Flatfish (filleted), B.C.	162.4

The particular group of products in this table is sold exclusively in North America, with the single exception of canned salmon, which is exported in some volume to Commonwealth and one or two European countries. Despite the different levels which the product prices reached by 1954, on an index basis, it is apparent from the charts that the course of prices over the years has been strongly influenced by the trend in disposable income in North America and a substantial part of the price increases for fishery products can be attributed to the influence of the general price level over those years.

There is a second group of products which has not yet been considered. These are the cured products—salted, dried, pickled and smoked —which are exported largely to Caribbean countries, where the absence of refrigerated distribution facilities restricts the trade in perishable commodities to these forms. The long-term price experience of these products is somewhat surprising, in that their relative level in 1954 compares favourably with that of products marketed on this continent.

Product	Marketed Value Index, 1954 1935 - 39 = 100
Cod, dried-salted[47]	380
Hake, dried-salted	590
Pollock, dried-salted	425
Mackerel, pickled split	408
Bloaters	320

With the exception of salted cod, these are minor items in the fish trade but they have an additional characteristic that sets them off from the group of products considered earlier. In varying degrees, they are processed by fishermen. In spite of this they are cheap products, relative to most of those in the first group, having an average marketed value of less than 17 cents a pound.[48] During the depression the real price of these commodities was actually below that suggested by the quoted price because they are not raw but finished products. The 1954 indexes, therefore,

do not represent a high current price as much as they do an abnormally low price in the base period. During the war and postwar period these commodities were caught in the general upward movement of raw product prices and, because they were export commodities and not subject to the Canadian price control policies, they made substantial price gains between 1940 and 1947 which were not continued in subsequent years.

Prices in the Postwar Period

The general price level in North America, as well as the level of world raw product prices, has been a significant factor in the price trends associated with Canadian fishery products over the last 30 years. In this entire period, however, only the last seven represent a set of conditions strictly comparable with those projected over the next 25 years—which are assumed to exclude war and depression and to include full employment, expanding real income and technological advance. As was suggested earlier, the period from 1949 to 1955 appears to be more suited to future projections than is the longer period 1935 - 55, although the effects of certain basic factors, like disposable income and the general price level, will not lessen in importance.

Assuming, then, that the year 1949 marks the beginning of the critical period for projection purposes, it may be desirable to review some of the price considerations that have so far been based upon 1935 - 39 relatives. If this base is shifted forward to 1949, a substantial change is brought about in the position of fish prices relative to that of all other commodities. In 1949 the average purchasing power of wholesale fish prices on the 1935 - 39 base was 134—in terms of the general wholesale index—but in the new series it becomes 100.

The trend of the index of wholesale prices of fishery products is compared with the trend in the general Canadian price level (both on a 1949 base) in Fig. 6. While the former index was below the latter for most of the period, their relative position at the end of 1955 was unchanged from 1949. In this connection it is of interest to note that the wholesale index of Canadian farm products lost ground relative both to the general index and to the fishery products index from 1951 onward. This date marks the beginning of a period in which the Canadian food market has been dominated by supply conditions and when the general course of raw product prices was retreating from the high point associated with the Korean hostilities. In North America, competition in food marketing reached a new high based upon the pressure of supply, the growth of chain store merchandising, advances in food technology and competition for the consumers' dollar from other fields.

Figs. 7 to 11 show the course of prices of the important species from 1949 to 1955 in comparison with the trend of the wholesale price index. For 1955 (1954 in a few cases) the relative position was as follows:

Species	Index of Average Landed Value, 1955 1949 = 100
Salmon, M & Q	153.6
Salmon, B.C.	132.9
Lobsters, M & Q	130.7
Pickerel (yellow & blue)	128.5[49]
Flatfish (excl. halibut), M & Q	122.9
Mackerel, M & Q	120.9
Whitefish	115.4[49]
Herring, B.C.	113.2
(General wholesale price index)	(110.4)
Flatfish, B.C.	108.8
Lingcod	106.8
Cod, M & Q	101.0
Lake Trout	97.4[49]
Herring, M & Q	84.9
Halibut, B.C.	83.8
Haddock, M & Q	76.5

The relationship between unit value, purchasing power and supply conditions suggested by these data is substantially unchanged from the earlier ones based on a longer time series — the same qualifications suggested in that case are attached to the figures shown above for lake trout, Pacific halibut and haddock. The strength shown by the price for mackerel is rather surprising because this species is generally considered to be a cheap fish in the raw state and it is used in fairly large quantities as bait by line and lobster fishermen.

Some implications of the relationship between the prices of particular species and those for their products in this recent period are shown in the next table, which compares average landed values with average marketed values as of 1954.[50] The value of the products listed was 80% of the total marketed value of all fishery products in 1954. The products of greatest importance, from the viewpoint of both domestic retention and the export trade, are included.

For most species, the price to fishermen in 1954 was the resultant of product prices which showed considerable variation relative to their position in the 1949 base period. The price relatives that are used for this comparison do not, of course, permit an assessment to be made of the weights of the products in terms of the total landed quantities. Salmon offal meal, for example, is not an important factor in the price of raw salmon; that price is dominated by the price obtained for the canned product. Each product, however, has some weight in the price level commanded by the species involved.

Species	Index of av. landed value, 1954 (1949 = 100)	Principal product forms	Index of marketed value, 1954 (1949 = 100)
Salmon, B.C.	124.1	Dressed	104.5
		Canned	114.4
		Offal meal	72.5
Lobsters, M. & Q.	128.6	In shell	117.4
		Meat	152.7
		Canned	88.8
Pickerel (yellow & blue)	128.5	Dressed	133.5
Flatfish, M. & Q.	108.9	Filleted	95.7
Mackerel, M. & Q.	115.5	Round	118.6
		Pickled, split	124.8
		Pickled, filleted	87.8
Whitefish	115.4	Dressed	109.5
Herring, B.C.	104.1	Meal	72.9
Cod, M. & Q.	105.0	Dressed	100.0
		Filleted	100.0
		Wet-salted	95.3
		Dried-salted, split	100.0
		Dried-salted, boneless	103.7
Lake trout	97.4	Dressed	102.0
Halibut, B.C.	102.1	Dressed	107.2
Haddock, M. & Q.	89.3	Dressed	93.3
		Filleted	101.6
Herring, M. & Q.	100.9	Round	140.0
		Kippered	98.4
		Pickled, dressed	110.9
		Vinegar cured, filleted	96.1
		Bloaters	120.3

With certain qualifications, these figures suggest that prices paid to fishermen advanced in relation to the prices of the relevant products in the case of Pacific salmon, lobsters, pickerel, Atlantic flatfish, whitefish, Pacific herring and Atlantic cod.[51] Unqualified inferences cannot be drawn about the effect of this changing relationship because of the possibility of increased productivity. It has already been pointed out that shifts in the origin of freshwater fish among the great number of lakes are accompanied by changes in the relationship of primary to secondary prices. In the case of lake trout the exploitation of distant lakes has brought about a relative lowering of prices to fishermen, but in the same period whitefish landings from the Great Lakes became increasingly important in the total landings of this species. The lower transportation costs from lake to market which resulted from this development probably account for the increase in whitefish prices to fishermen in the face of the smaller increase in the average marketed value of the dressed product.

On the whole, however, it would appear that there was a tendency for producers of the expensive species to get an increasing share of the market returns during the period, while producers of the cheaper species obtained less. This would seem to be consistent with the view expressed earlier that the supply potential is one of the important factors in setting the scale of prices that is associated with the various species. Each fish population has certain natural characteristics associated with it which contribute to the costs of exploitation, e.g. the nature of the bottom or habitat, depth of water over the grounds, reproductive, growth and mortality rates, density of population relative to a unit of area, daily vertical movement, seasonal migrations, port location in relation to fishing grounds and the distance of ports from important markets. Obviously, two populations of the same numerical size may not represent the same potential supply for commercial fishing. A population with a high reproductive rate, rapid growth rate and a low natural mortality, which is normally found on "clean" grounds at reasonable depths, represents a larger potential supply than a population similar in size but with characteristics opposite to these.

From the point of view of the market, fish from the first population are likely to be lower priced, under similar demand conditions, and the supply (landings) more responsive to price changes. These supply differences may, of course, be strengthened or weakened by the level of demand associated with the particular species or its products. It has already been indicated that, over a long period of time, the prices of all products and of all species have been affected by the trend in the general price level. Both tended to rise or fall in a consistent relationship, as the charts referred to earlier indicate. Throughout the period covered, however, while the price of individual species and their products moved in the same direction, they moved at different levels which were determined by individual supply conditions and, apparently, unique demand associations.

In 1954 the marketed value of salmon canned in British Columbia and of lobsters in all forms from the Maritimes and Quebec made up altogether 40% of the total marketed value of Canadian fishery products (excluding Newfoundland). The price gains which they registered account for practically all the gain made by the index of fishery prices from 1949 onwards and outweigh the losses associated with a wide range of other products. For Newfoundland this period was particularly difficult because of the continued dependence upon salted cod. Marketed value data are not available for the products of the fisheries of that province, except as rough estimates. Some information is available, however, on prices paid to fishermen for shore fish[52] and it would appear that by 1954 it had declined to about 75% of the 1949 level. In terms of the general price level, the purchasing power of this commodity declined in those years by 32%.

5

THE FUTURE DEMAND FOR FISHERY PRODUCTS

THE DEGREE to which the fishery resources of this country will be exploited, and the extent to which capital and labour will be attracted to the fishing industry, will depend in part upon the future demand for fishery products. The qualification "in part" is introduced because of the distinct possibility that developments in the future may bring substantial changes to the present pattern of sea and lake fish utilization. Increased leisure and growing incomes may divert some fisheries from commercial use for food production to angling for recreation. Power requirements may bring about water utilization that will reduce or destroy certain fish populations. These are possibilities portended by signs now visible but their eventual realization cannot be assessed at this time. There are enough uncertainties in the questions which arise when the consideration of future development is restricted to the utilization of fish for food and industrial purposes. In this limited area a general basis for statistical projection is provided by two conditions: a) the reasonably stable pattern of total landings, processing and sales in recent years and b) the fairly clear association among factors like population and fish consumption, the general price level and fish prices, and disposable income and prices.

As a first step in considering future demand, it can be assumed that the population of North America will continue to dominate the marketing situation, perhaps to a greater extent in the future than at the present. The number of people involved, whether actual or potential consumers of fishery products, the high level of their incomes and the facilities for the wide distribution of all forms of food products all point to the continuing importance of the market on this continent. In addition to the quantitative advantages there is also the advantage, in food marketing, of the desire shown by these consumers for variety.[1] Food is not only plentiful in quantity, but it is also extremely varied in form, and it is the search for variety that accounts, in a large part, for the demand for many food items. In the case of fishery products it is this factor that is probably most important in explaining the wide range of products that are regularly imported into both Canada and the United States from a large number of countries.[2]

In recent years the quantity of food consumed, and the proportion of income spent for food, has remained remarkably stable in the two countries. At the present time, about 25% of disposable income is estimated as food expenditure and this proportion has shown little variation in the postwar period, indicating that the national food budgets have withstood the newer demands associated with television, automobiles, gadgets and leisure. This is not to suggest that food merchandising is in a static, or stagnant position; it has already been remarked that the years from 1948 were characterized by a high degree of competition in the food business. Substantial advances in technology and merchandising have taken place—induced, perhaps, by a demand for foods that are portioned, wrapped, pre-mixed or pre-cooked to release the housewife from yesterday's kitchen drudgery. Such advances have kept these foods in the competitive race for the family dollar.

The statistical aggregates dealing with food consumption and expenditures on food in North America, and the known facts about the competitive position of the food industries, suggest that the demand for food products can reasonably be expected to keep pace with the demand for other goods and services in North America in the years to come. The human stomach sets ultimate limitations upon food requirements; adequate nutrition sets the lower limit and income, habit and taste set the upper limit. Thus the intake of food can be first regarded as a function of the number of stomachs to be filled, but with many factors coming into play in the choices which determine the importance of the components making up total intake.

In a period of rising prices and of expanding populations and incomes, the total quantity of money spent for food will be a function of the number of stomachs and the prices of the component foods; and, because of the association between the general trends of prices and incomes, the relationship between income levels and food expenditures ought to be, as it is, fairly constant.[3] There seems to be, therefore, no reason to look forward to any decline in the position of all food in the budgetary competition of the future. The more pertinent question for the present purpose is the prospect for fishery products. At this point note has to be taken of a considerable body of opinion that relegates fish to a "poor relation" position in the general economy.[4] Fish, and the amateur fisherman, are the subject of frequent sallies by cartoonists and humorists. Certain sectors of the industry both in Canada and in the United States have been criticized for their slow adaptation to modernization and innovation in production and marketing techniques. Housewives, according to questionnaires, complain of the odour, of the presence of bones and sometimes of the price associated with fish products. In popular parlance, fishery products appear to enter the market with two strikes on them and, if the allegations were all true, it is hard to understand how these products could have survived the food competition in North America during the last 20 years.

In fact, as the earlier sections on prices suggest, some fishery products have fared quite well in this food competition. There are a number of such products that are now classed as luxuries and command higher prices than do expensive cuts of meat, especially on an edible weight basis. Certain products have lost favour in the North American market over the years, e.g. salted cod and smoked fish, but to a large extent they have been replaced by forms developed later, like frozen fillets and fish sticks.

It is true that the per capita consumption of fish in both Canada and the United States is only a small proportion, less than 10%, of that of animal proteins produced on farms, and this low figure is often compared with the per capita levels of fish consumption in Norway, the United Kingdom and Japan. Very seldom, however, do these comparisons include references to the agricultural productivity of North America in relation to that of the heavy fish-eating countries. An "eat more fish" movement in Canada could have a net increase effect for only a few species: cod and herring from Atlantic waters, salmon from the Pacific perhaps. Most other important species available to the industry in this country are being fished at or near sustained yield levels already and if Canadians eat more somebody else will have to eat less—which may or may not be a good thing.

Demand Projections, 1980

With these considerations in mind, the question of the future demand for fishery products is examined here with reference to two major factors: a) population growth and b) disposable income. It is recognized that there are many other factors which influence the demand in North America for fishery products, but they are difficult or impossible to assess quantitatively and exploratory investigations suggest that they are not very significant.[5] For reasons already advanced, analysis of the consumption of fishery products in Canada is based on the period from 1949 to 1955. The period is rather short for statistical operations of this kind but, in the case of most of the major products, the detailed data required are not available beyond 1949. This particular period, however, does have the advantage of conforming, in respect of the nature of prevailing economic conditions, with assumptions for the next 25 years.

For most products consumed in any volume in this country, there appears to be a fairly good correlation between population and domestic retention, or consumption as it is generally referred to. Regressions in which price is plotted against disposable income as the independent variable do not give significant correlations, which seems to substantiate the opinion expressed earlier that demand for fishery products within quite wide price ranges is relatively inelastic.

The United States, which is a more important market than the domestic one, presents a more difficult analytical problem because Canadian exports of fishery products are such a small fraction of U.S. food consumption that they tend to get lost in the magnitude of total food supplies in that country. An analysis similar to that made for Canada would have to involve a calculation of U.S. domestic retention by major forms and would require statistical information that is either not available or not current. Since population was considered as the significant factor affecting the consumption of fishery products in Canada, it seemed reasonable to apply the same reasoning to the United States as a market for our exports.[6] Projections are thus made on the basis of average exports plus 43%, which is the median increase among the current projections of the U.S. population.

These two calculations provide a first approximation to the demand which might be expected by 1980, on the basis of the general assumptions about economic conditions in the future and the substantial significance of population increase. In later sections these statistical projections are examined in the light of general knowledge about the special demand characteristics of major products and, in some cases, they have been adjusted to conform either with the known limitations on the fish stocks involved or with overriding demand considerations.

For some products, the data on production, domestic consumption and exports in the base period give no clear indication of trends that could be projected into the future with any degree of confidence and for these the average production over the last few years is used as the basis for estimating future utilization. In addition, there are a great many minor products which, in total, are not large enough to influence any general conclusions about the future of the industry and, for that reason, are ignored here. The results of all these calculations, modified by judgments about their reasonableness, are presented on page 77.

For the products considered here, the round weight equivalent, i.e. the weight of the whole fish required to produce these products, is 2.1 billion lb. or 800 million lb. more than was required to meet the demand for these same products in 1955, an increase of 60%. It is necessary at this point to reconsider the meaning of the figures shown, to avoid confusion in their use. These are demand projections for the products of the Canadian fisheries made on the assumption that supplies of raw fish will be available to Canadian fishermen. This assumption, however, takes no cognizance of the limits that are placed upon annual catches by the production-cost factor or by regulation in the interest of preserving the stocks for future use. Neither does it take into consideration the effect of international competition in the fisheries conducted on the high seas.

The latter conditions are obviously related to the future supply of Canadian fishery products and the ability of the Canadian trade to meet the demand projections of this section. The shape of future limitation

Estimated Demand for Specified Products of the Canadian Fisheries, 1980

Product	Product weight million lb.	Round weight million lb.
Fresh and Frozen, round and dressed		
Salmon	65	78
Halibut	36	49
Lobster (in shell)	44	44
Smelts	7	7
Pickerel	29	29
Whitefish	31	35
Lake Trout	8	9
Fresh and Frozen, filleted		
Cod	152	494
Haddock	57	170
Flatfish	31	114
Redfish	17	69
Lobster (meat)	3	13
Salted and Dried	106	424
Canned		
Salmon	108	190
Herring (incl. Sardines)	19	45
Tuna	5	10
Meal	72[7]	360
Total	N.A.	2,140

on catches is already fairly clear in the light of the extensive conservation measures now in effect. With the exception of groundfish and herring on the Atlantic Coast, nearly all of the important commercial species are now guarded against excessive exploitation by fishery management programmes of one kind or another. The International Commission for the Northwest Atlantic Fisheries is studying the question of the exploitation of the groundfish populations in the area with which it is concerned, and this co-operative international effort stems in some degree from concern about fishing pressure on these populations. Atlantic herring is not subject, at the present time, to similar concern and the exploitation of this species is limited only by the accessibility of the stocks in relation to the demand for the products of the fishery.

Present market requirements, therefore, are pressing upon the physical quantities that can be taken each year from most of the stocks of both sea and freshwater fish. If, then, the market requirements of the future suggest an additional over-all requirement of 800 million lb., the implication for the course of prices is reasonably clear. The strengthening of fish prices which may be anticipated from these considerations raises some questions, which must remain unanswered at this time, about cost-

price relationships and the possibility that changes in these relationships, along with advances in physical productivity, may lead to an intensification and/or extension of certain fisheries under conditions of higher costs and thus effect substantial changes in the present pattern of exploitation.

The questions that arise from consideration of international competition on certain fishing grounds are also best left to the answers that will be provided by actual developments in the future. Economic development in a number of countries abroad, the nature of their future national policies, both domestic and foreign, are factors of vital importance in this field. They are, however, largely unpredictable.

Factors Influencing the Demand for Specific Products

In the earlier section dealing with prices, reference was made to the probability that there is a particular demand associated with each major product and with each group of substitutable products of the Canadian fishing industry. In some cases, the explanation is directly related to the market orientation of the particular product: salted cod is sold almost entirely outside Canada, while oysters are almost entirely consumed in this country and the demand for each is obviously a function of quite different factors. Similar differentiation of the specific demand associated with other products of the industry is not so straightforward as in the examples chosen here, owing to the absence of information of a descriptive and statistical nature. Moreover, the range of products alone precludes a complete coverage of this particular subject and the sections which follow deal only with some of the more important products and with one or two groupings in which the component items exhibit considerable homogeneity. The measurement or description of demand is not often accomplished in a satisfactory fashion with the best of data and, in the present case, the information available is far from adequate. The observations and judgments which are presented, however, along with a small number of facts, are at least an indication of the differences in demand that are associated with some major fishery products.

Canned

There are at least 40 identifiable types of canned fish produced in Canada, but the industry is dominated by the canning of salmon on the Pacific Coast and that of sardines (immature herring) and lobster on the Atlantic Coast. In 1954, the last year for which information is available, the marketed value of canned salmon was $38.4 million, of canned sardines $5.4 million and of canned lobster $4.0 million. The domestic market now consumes about two-thirds of the production of these products and the balance is exported. The present pattern of export trade still

preserves the imprint of the historical importance of Commonwealth markets, which have declined in relative importance since the war because of exchange difficulties.

Although there is not much factual evidence in support of the statement, it is probable that there is some competition among these three products on the domestic market, but it may not extend into the markets abroad. In Canada there may be a considerable amount of similar utilization in households and restaurants, e.g. as sandwich fillers, salad components and snacks of one kind or another. However, the data available on domestic consumption of canned lobster and sardines do not suggest any significant trend in the last seven years and it may well be that consumer preference is rather less important than some other factors in determining the sales level in this country. For example, the sardine industry faces each year the vagaries everywhere associated with herring supplies. In some years the runs in the Bay of Fundy result in catches that are larger than the canneries can accommodate and the surpluses are sold for utilization as pet food and fertilizer. The average size of the fish in each run is almost as important, from a marketing point of view, as is the total supply for canning. Large fish result in a pack with a small count per tin, which has a lower unit value than one made up of small fish. In Canada quite distinct markets for sardines are associated with the count per tin, as well as the type of oil and seasoning included. Market requirements, however, have to take second place to the actual outcome of the catch each year and this condition may account for the inexplicable variation in domestic consumption in recent years.

The sardine industry of the United States is centred in Maine and there is a good deal of competition for raw material between canners on both sides of the international boundary. Some years find Canadian canners buying from Maine fishermen and vice versa, depending upon the movement during the season of the herring schools. Canadian exports of the canned product to the United States are negligible, owing to the 10% tariff and to the competition offered by the large and well-organized Maine industry.

There is very little more evidence of a trend in the consumption of canned lobster in Canada than there is in the case of sardines. In part this may be due to the shortcomings of the statistics on this commodity—figures on stocks are not available — but an important factor is probably the variation in the supply which has been apparent for some years: in 1954, for example, the pack was 84 thousand cases compared with 50 thousand in 1947, although the general trend is downward. The effect of natural factors on the supply of lobsters for canning is complicated by the price competition which comes from the market for this species sold in the shell.[8]

Canned lobster is numbered among the luxury products of the fisheries, not only in Canada but also abroad, but postwar prices rose to levels (the equivalent of $2.50 per lb. of meat) that brought about considerable consumer resistance. In 1953 the federal regulations governing the net drained weight of canned lobster were changed to allow a reduction in the contents of the three can sizes used in the trade. One of the arguments used to support the change was that the commensurate reductions which could be made in prices would make the commodity more competitive in the markets.

About 75% of Canadian exports of canned lobster now move to the U.S. market and are imported free of duty into that country under the M.F.N. schedule. This particular tariff, on a manufactured item, reflects the preoccupation of the Maine and Massachusetts lobster industries with the more valuable market forms and the fact that there is no canning industry faced with competition from Canada.[9]

The demand for canned salmon is one of the stable factors in the Canadian fishing economy. British Columbia processors (the canning of Atlantic salmon is negligible) have produced the commodity for more than three-quarters of a century, and its keeping qualities and palatability have made it a favourite among more domestic consumers than are reached by any other product of the Canadian fishing industry.

The estimated utilization of Pacific salmon for canning in Canada probably will reach a total of 2.3 million (48 lb.) cases by 1980, and the projected market requirements suggest that 1.4 million cases will be consumed in Canada, 200 thousand will be exported to the United States and the remaining 700 thousand will be sold to markets outside North America. The growth of the domestic market is illustrated by the fact that, while in 1939 only about 35% of the pack was sold in Canada, Canadian consumers today are buying approximately 65% of the pack, and it is expected that the domestic demand in 1980 will absorb about 60% of total production.

Canned salmon possesses a special consumer preference which is shared, but to a lesser degree, by only a small number of other fish commodities produced in Canada. The demand in North America has been developed and nurtured through advertising and other forms of promotion. Perhaps the greatest emphasis in the domestic market has been placed upon the identification in the minds of housewives of quality with specific species and brand names. For example, the consumer has been conditioned to believe that sockeye is a more delectable commodity than pink or chum. Intensive promotion of canned sockeye in past years has been carried on by some packers under their own brands with the result that all producers of this particular commodity have benefited in terms of price. The red flesh of the high-priced sockeye is attractive to the eye

but it is a matter of opinion whether its taste differs significantly from that of the relatively low-priced pink and chum.

The demand for canned salmon in North America is directly related to the keeping quality of the product. Canned salmon is found universally in grocers' stocks because its shelf-life is of long duration. The commodity's popularity results also from the fact that the fish is pre-cooked and can be readily used as a sandwich spread or in salads. The domestic demand for canned salmon is relatively slow to respond to fluctuations in price, both absolute and relative in nature. Domestic retail prices have risen steadily in recent years and sales have increased at the same time. The comparison between canned salmon prices and disposable income (Fig. 14) suggests that there has been little relationship between these two factors in the postwar period. This is especially significant in view of the rather violent fluctuations in meat prices from 1951 to 1954 (Fig. 15). Similarly, there has been apparently little or no relationship between the disposable income of consumers and the domestic consumption of canned salmon during the past few years (Fig. 16). There is strong evidence, however, that the price range within which Canadians purchase canned salmon in the long run has quite flexible upper limits. This does not necessarily imply that an abrupt price rise does not divert some customers to competitive commodities such as canned tuna, but there is little evidence of any prolonged shifts of this kind in consumption in recent years.

As already stated, domestic consumption of canned salmon, which in 1955 totalled about one million cases and included a large part of the sockeye pack, is expected to approximate 1.4 million cases by 1980. The assumption that domestic consumption will increase in a fairly constant ratio with population is supported by the regression analysis of these two variables for the period 1948 - 54 (Fig. 17). The price factor, which places canned salmon in the luxury class relative to most Canadian fish products, is a less significant determinant of demand in export markets than in Canada; but rising prices are not expected to discourage domestic consumption. Trade restrictions in export markets, which limit the sales of canned salmon abroad, place an increasing emphasis on the domestic market, and British Columbia canned salmon packers are better equipped than any other sector of the processing industry to develop the home market through promotion of their product.

Demand for canned salmon in almost every foreign market, whether it be the United States, the United Kingdom and other Commonwealth countries, the countries of Western Europe, the Caribbean area or elsewhere, is subject to government controls which restrict imports in various ways. For example, the U. S. government, in order to protect its domestic salmon canning industry, imposes a 15% *ad valorem* tariff on Canadian canned salmon. The tariff discourages importation of canned sockeye salmon but permits the entry of considerable quantities of the lower priced canned pink

and chum, upon which the *ad valorem* rate is less burdensome.[10] The United Kingdom in the pre-World War II period was the major importer of Canadian canned salmon but shortage of dollar exchange in recent years has compelled that country to impose quota limitations on this commodity. Similarly in other Commonwealth countries belonging to the sterling block, in European countries like France, Belgium and Italy, and in most Caribbean countries, problems of exchange constitute the principal check on current exports of Canadian canned salmon.

The import controls on Canadian canned salmon which the governments of most consuming countries are forced to maintain at the present time, tend to obscure price competition and consumer preference in those countries. For example, Japanese exporters currently are offering canned salmon to the United Kingdom at lower prices than those charged for the Canadian product but it is the ability of the U.K. importers to pay in soft currencies for Japanese salmon, rather than the price factor, which places the Japanese in a favoured position. Government controls in importing countries probably will continue to affect Canadian exports of canned salmon outside the American continent in the foreseeable future. The continuation of controls will likely permit only a gradual increase in export trade rather than a return to the levels which obtained in the prewar period. The government of the United States is expected to continue its protective attitude towards the American canning industry, which will restrict the movement of high-priced Canadian canned salmon to that market.

Fresh and Frozen

Practically every species exploited commercially in Canada is represented in the group of products preserved by chilling, i.e. in the fresh form, or freezing.[11] The quantities produced and exported in 1954 are summarized as follows:

	Production	**Exports**
	million lb.	million lb.
Fish, round and dressed, fresh	280.3	
Fish, round and dressed, frozen (incl. steaks)	58.4	
Subtotal	338.7	179.6
Fish, filleted, fresh	22.2	
Fish, filleted, frozen	116.1	
Subtotal	138.3	114.3
Shellfish[12], in shell	43.3	24.5
Shellfish, meat	5.7	4.8
Total	525.9	323.3

The export value of all fresh and frozen products in 1954 was $72 million, as compared with $25 million for all canned fish and about

$22 million for all cured products. North America is almost exclusively the market for the fresh and frozen products of the Canadian industry and is likely to remain so in the foreseeable future. Small quantities of frozen products are beginning to appear in some of the Caribbean markets but distribution is confined to three or four of the larger cities on the islands. In addition to their common market characteristic the products in this group have a degree of homogeneity related to their use in homes and restaurants. To a large extent, they form the protein base of meals and thus would appear to come into direct competition with animal protein foods of farm origin like beef, pork and fowl used for the same purpose. A typical restaurant menu in North America lists meat entrées along with a few fish entrées based upon fresh or frozen products. The whole menu provides the patrons with a range of choice in which price and the desire for variety are both taken into consideration.

At this point exception may be taken to the grouping of a large number of products, varying widely in price, in view of earlier statements about the diversity of demand factors associated with the major fishery products. In accordance with that line of reasoning, in fact, lobsters are considered in a separate section later and the minor shellfish—scallops, oysters and clams — because of their relative unimportance, are ignored. The fresh and frozen products included in the present grouping are thus restricted to those originating in landings of fish other than shellfish from the sea and inland lakes.

A further justification for the aggregation of these products for this particular purpose becomes apparent in the examination of consumption trends in Canada and the United States. Attempts to correlate consumption of some of the more important individual products with Canadian population for projection purposes have not been too encouraging. The trend line for fresh dressed Pacific salmon is utterly unlike that for the same product frozen. The projection for the latter results in a negative consumption by 1980 (Figs. 18 and 19). The same disparity occurs in the case of frozen and fresh halibut (Figs. 20 and 21), except that it is the fresh product that ends up in a negative position by 1980.

A great many individual fresh and frozen forms have been treated to this kind of examination, with generally conflicting results or the absence of any discernible trend during the period. When the domestic consumption levels of some similar products are accumulated, however, rather better results are apparent, e.g. in the case of all fresh and frozen dressed products (Fig. 22) and all groundfish fillets (Fig. 23). When these two groups of products are combined, and the total domestic consumption plotted against population from the 1949 to 1955 period, a satisfactory fit is obtained, i.e. one that supports an acceptable projection of requirements (210 million lb.) for 1980 (Fig. 24).

The analysis suggests that there may be a homogeneous demand for fresh and frozen products in Canada, with the inference that a considerable degree of substitution exists among the products of a relatively wide range of species: Pacific salmon and halibut, Atlantic cod, haddock and flatfish, and whitefish, trout and pickerel from the inland lakes, to name a few. This substitution, however, may not take place across the board, so to speak; it is more likely that it occurs within large areas of the country, or within certain income ranges in areas where most of these products are available either all year round or through the season. The substitution taking place among the group as a whole is probably the sum of smaller systems of substitution based upon local factors like price, taste and supply. If this particular thesis seems too tenuous it might be well to look at another characteristic of the marketing of fresh and frozen products that has some relevance in the same connection.

The extent to which the trade in these products is orientated to the U.S. market is borne out by the concern of Canadian exporters with conditions and developments in that market and its importance to Canadian production. In addition, there appears to be a clear-cut relationship between Canadian exports to the United States and the growth of population in that country. The clearest indication of this relationship is provided by a comparison of Canadian landings of freshwater fish and U.S. population (Fig. 25). In this particular case, landings, rather than exports, were considered because the freshwater fisheries are so closely linked with the U.S. market.

Exports of fresh and frozen groundfish fillets to the U.S. also appear to be rather closely related to the growth of population in that country (Fig. 13), and this conclusion with respect to part of the total U.S. supply is strengthened by the close relationship between the trends in consumption and population there from 1949 to 1955 (Fig. 26). The analysis suggests that the demand for these products in the United States has been a first charge upon Canadian supplies and, to the extent that this is so, the domestic market is served with residual supplies. This conclusion may seem incongruous to those who are familiar with the competition that has characterized the Canadian market for some of these products recently, but such competitive outbreaks have generally been of short duration and have never involved the whole range of products at one time.

Volume, of course, is of substantial importance in the marketing of any product and sustained volume in a particular market may outweigh the promise of price advantages in smaller markets. The volume potential of the U.S. market has for long been very much in the minds of Canadian exporters, perhaps too much so in some cases, and this push is reinforced by the pull exerted by brokers and chain store buyers in the United States who are interested in continuity of supply and a "full line", i.e. the widest possible range of products.

The competition between these two markets may well become keener and of more concern to the trade if future demand comes anywhere near the projections estimated earlier. The pressure from two expanding populations upon a resource base which has some obvious limits will have an effect not only on prices generally but also, no doubt, on the present market orientation of the Canadian trade. In large part, the effect may depend upon the extent to which the domestic market is able to compete with the U.S. market for Canadian supplies. The case of the oyster may be pertinent here. This species has been in scarce supply for years, and retail and restaurant prices have reached levels in Canada which would be expected under these supply conditions. Oysters are free under the U.S. tariff and there are no other restrictions upon exports to that country. Nevertheless, the Canadian market retains all the domestic production and substantial quantities are imported from the United States as well each year.[13] The oyster may not be a reliable guide to the future in this connection but its present marketing pattern suggests that Canadian consumers can dominate a market under certain, perhaps rather special, circumstances.

For the important products of the Canadian fisheries, however, this inter-country competition may well result, initially, in the disappearance of certain products which appear to be less valuable than others in terms of prices realized. In the case of groundfish, for example, the growing demands of the fillet trade for raw product will probably be met in the early stages by drawing supplies away from the processing trades engaged in salting, smoking and canning, rather than by a re-alignment of the fillet market between Canada and the United States. For a good many species there is likely to be a substantial amount of inter-form competition in the years ahead if the present demand and supply projections are borne out by developments. In this connection, the fresh and frozen trade may benefit to a relatively greater extent from advances in food technology and from the provision of more and better refrigeration facilities in North America. Technological progress can provide better and more desirable products, especially as these approach the original characteristics of really fresh fish; and the proliferation of refrigeration facilities will provide the distribution base necessary to bring these products within physical reach of an increasing number of consumers.

The tentative conclusion about the general nature of the demand for Canadian fresh and frozen fishery products is that they may be considered as a group of substitutable items for this purpose, and that their general homogeneity arises from consumers' desires for fish as nearly as possible in the fresh state. To satisfy this want, consumers will accept some unknown degree of substitution when supplies of a particular product are not available or when the price pattern of the group forces alternative products upon their attention.[14] In the rest of this section more detailed information

is provided on the conditions affecting the market for some of the important products in this group.

The demand for Pacific halibut can best be understood in relation to the annual supply situation, which is governed by conservation measures. There are developed by the International Pacific Halibut Commission which has as its primary purpose to assure to the halibut industry a maximum sustained yield. Since its establishment in 1924, this agency has regulated both Canadian and U.S. fishing by annual catch quotas in defined fishing areas.

The U.S. market at the present time absorbs about 70% of Canada's Pacific halibut production. Exports to the United States in 1955, for example, of about 14 million lb. dressed halibut may be compared with production in the same year of 19 million lb. of that commodity. In addition, most of the production of halibut fillets, including some packaged fillets, amounting to 2.6 million lb. in 1955, was also exported to the U.S. The United States imposes a tariff of a half cent per pound on fresh and frozen dressed halibut and 1½ cents per pound on fillets. These rates do not discourage the export trade and are not expected to constitute a deterrent in the future.

The halibut trade embodies a rather unique marketing organization made up of specialized brokers, distributors and importers. Most of the Canadian halibut catch is frozen when landed and the bulk of the product is put into storage. The frozen halibut is shipped out of storage according to requirements throughout the ensuing 12 months. The absence of a pronounced seasonal pattern in marketing may be due in part to the fact that the peak of landings, in May and June, coincides with the incidence of heavy catches of other seafish and freshwater species. A substantial movement out of storage, however, does take place during the fall and winter months.

The marketing of Pacific halibut in recent years has been relatively undisturbed by violent price fluctuations. Occasionally circumstances combine to bring about an unsettled market and, at the same time, to emphasize the somewhat inflexible elements in the trade. Such a situation developed in 1954 when a near-record catch by U.S. and Canadian fishermen followed a heavy carry-over of halibut caught in 1953. Canadian halibut exports in 1954 exceeded those of previous years and stocks in U.S. warehouses rose above what is considered a normal level, with the result that the price of halibut declined eventually to distress levels in mid-1955. An easing of the inventory surplus brought about a recovery of halibut prices by early 1956. The short catching season for Pacific halibut has a marked effect upon the trade and, indirectly, upon acceptance of the product. The distributive system as it exists today is limited in the volume it can accommodate at a given time. The frozen product has a long shelf-

life but its quality usually suffers as the result of protracted storage. Improved quality and greater acceptability may be achieved with progress in the technological field, e.g. the use of antibiotics for fish preservation.

The fresh and frozen phase of the salmon industry in British Columbia began with fish dealers supplying fresh salmon to a clientele in a limited geographical area adjacent to the fishing grounds. Its growth through the years has followed the development of refrigerated rail, truck and steamship facilities until today fresh and frozen salmon can be purchased in many areas of the United States and Canada. Icing and freezing utilize most of the salmon which is not packed in tins, with the whole or dressed forms predominating.

The fresh and frozen salmon industry relies to a large degree upon sales to the western United States. The production of B.C. frozen salmon totalled about 13 million lb. in 1955, and in the same year 10 million lb. (some of it from the 1954 catch) was exported to the United States. The export trade fluctuates with the availability of the various species. Fresh and frozen chum and coho salmon, in the round or dressed form, are imported by canneries in the northwestern United States each year, but the volume depends upon the surplus available after requirements of the B.C. canning industry are met. The spring salmon, which is sold very largely in the fresh and frozen form, finds ready outlets in the western United States, particularly in California. Some springs are mild-cured in Canada for the U.S. trade but increasing quantities are being sold directly for curing in that country.

The requirements of the U.S. market for fresh and frozen salmon, either for consumption as such or to supplement raw material supplies for the canning industry of that country, are of sufficient magnitude currently that the customs tariff imposed upon these commodities is not considered a significant barrier to trade. It is expected that import requirements in the United States will expand in a fairly constant ratio with the population increase in that country through 1980 and that the tariff will not be raised above its present level. The characteristics of the U.S. demand for Canadian fresh and frozen salmon are less well defined than those which apply to canned salmon. Prices do not appear to be of major importance, as indicated earlier. These products belong in the near-luxury class, as evidenced by an average Canadian export price for dressed red spring salmon of 42 cents per pound in 1955. It is expected that the U.S. market requirements for Canadian fresh and frozen salmon will absorb the greater portion of available supplies in 1980. These requirements probably will be in the neighbourhood of 25 million lb. (product weight) of fresh round and dressed salmon and 17.5 million lb. of frozen salmon.

The domestic requirements for Pacific fresh and frozen salmon are expected to increase to approximately 23 million lb. by 1980. The demand for these relatively expensive food commodities may be expected to in-

crease as the disposable income of Canadian consumers rises. They probably will appear on the tables of many more Canadians in 1980 than is the case today. Fresh and frozen salmon has certain qualities of taste and texture, when held under satisfactory temperatures throughout the various stages of distribution, that give it a preferred position in the buying habits of the consuming public. The key to the expansion of the market appears to lie in improved refrigeration facilities from the fisherman to the retailer.

The projected demand for freshwater fish caught in Canadian lakes is based upon exports and domestic consumption in the years 1949 to 1955 as related to the forecast population increases in the United States and Canada. The total demand for Canadian freshwater fish in 1980 probably will be in the neighbourhood of 150 million lb., round weight. In product weight, the U.S. demand would represent 77 million lb. round or dressed fish, fresh and frozen, and 15 million lb. of fillets, fresh and frozen (comparable export figures in 1955 were 49 million and 14 million lb., respectively). Domestic demand in 1980 is expected to approximate 28 million lb. round and dressed fish and 5 million lb. of fillets.

Both fresh and frozen lake fish are subject to more erratic fluctuations in price over short periods than are fresh and frozen sea fish. The cause of price fluctuations lies in factors peculiar to the market and to the industry itself which tend to accentuate the effect of the general economic factors of supply and demand. Fishing is widely scattered over a large number of lakes and the transportation factor often has an important short-run influence upon price levels. The problem of transportation presents little difficulty to producers on the Great Lakes who can ship by highly efficient refrigerated truck transport or rail express to Detroit, Chicago or New York. Fish caught in northern lakes, however, must be collected, often under difficult circumstances, and transported by rail or highway over great distances.[15] Shipping over long distances frequently involves irregular arrivals at distribution points, thereby creating a temporary shortage which results in a sharp price rise. Distance, of course, also increases the difficulty of preserving quality — involving an additional hazard to price stability, especially when the goods are sold on a consignment basis.

The demand for freshwater fish has a unique characteristic arising from religious practices. Hebrew religious observances, particularly in the summer and fall, by custom utilize freshwater fish prepared in kosher style in the diet. Consumption of lake fish on such occasions is declining in significance, perhaps, but it remains an important factor in determining demand which is thus associated with the Sabbath observance and with the thirty or more special holidays and fast days that occur each year. The marked increase in demand at these times in cities which have large Jewish populations accentuates the fluctuation in lake fish prices arising from other causes.

Demand projections for 1980 are shown in greater detail in the following table:

Species and Form	Market	Projected Demand in 1980 (product weight) million lb.
Pickerel (yellow and blue)		
Round or dressed	Domestic	10.0
	U.S.A.	19.0
		29.0
Fillets	Domestic	2.0
	U.S.A.	8.0
		10.0
Whitefish		
Round or dressed	Domestic	5.0
	U.S.A.	26.0
		31.0
Fillets	Domestic	1.0
	U.S.A.	1.0
		2.0
Lake Trout		
Round or dressed	Domestic	3.0
	U.S.A.	5.0
		8.0
All Other Species		
Round or dressed	Domestic	10.0
	U.S.A.	27.0
		37.0
Fillets	Domestic	2.0
	U.S.A.	6.0
		8.0

The tariffs imposed by the United States upon imports of Canadian lake fish is not an important consideration in forecasting future demand for these commodities. In *ad valorem* terms the specific rate of a half cent per pound on dressed lake fish is of negligible significance when related, for example, to the case of drawn whitefish retailing in Chicago at a peak of 95 cents per pound. Total North American supplies of lake fish are limited and, because of the apparent constant demand for these species in the United States, the likelihood of increased rates is not very great.

The course which U.S. demand for Canadian lake fish is likely to follow over the next 25 years will probably be marked by a continuation of present high consumption levels and increased imports associated with

the population increase. Consumption of lake fish by Canadians probably will also tend to grow at a fairly constant rate with the country's population (Figs. 27 and 28). Prices will probably move at generally lower levels than in the United States but will be subjected to the same upward pressures as are likely to be present in the larger market. Consumption of lake fish in Canada in 1980 may be limited, however, by the diversion of supplies to meet the requirements of the more rewarding U.S. market.

The largest contribution to the Canadian supply of fresh and frozen fish products originates with the Atlantic demersal species which include cod, haddock, pollock, hake, cusk, redfish and the small flatfishes like plaice, winter-flounder, witch and yellowtail. Upon occasion these Atlantic species are grouped under the general term "groundfish" which, unfortunately, is not entirely suitable from the descriptive point of view, nor is it in general acceptance throughout the industry. Not all of the species live or feed entirely upon the bottom; redfish, for example, move in a daily cycle from the sea bed to its surface. The flatfishes are true bottom dwellers and are more accurately described as groundfish than is the group composed of cod, haddock, pollock, hake, cusk and redfish, although the latter group is commonly meant when the term is used in some contexts.[16]

At one time filleting, as a market process, was largely confined to these Atlantic Coast species, but in recent years an increasing quantity of fillets has been prepared from freshwater fish like pickerel and pike and for some time there has been a small but consistent utilization of Pacific species in this form. The filleting process provides consumers with a product that is entirely edible, if the skin and pin bones are removed in the plant. Transportation costs are reduced if only the edible portion is shipped but this saving is offset, to some extent, by the labour involved in cutting and packing.[17]

In 1955 the production of Atlantic groundfish fillets totalled 157.7 million lb., which were cut from the various species as follows:

	Million lb.
Cod	68.7
Haddock	44.0
Redfish	11.0
Flatfish	30.8
Other	3.2
Total	157.7

Of this total, 108 million lb. were exported to the United States; so the size of that market relative to the domestic market is roughly two to one. Exports to the United States have grown from about 18 million lb. in 1939 to the present figure.[18] This expansion, which parallels the decline of the New England groundfishing industry, has led to constant

charges that imports are the factor responsible for that decline. The Canadian groundfish fillet industry has been subjected to examination four times since 1949 by agencies of the U.S. government in this connection and, at the time of writing, an appeal to the U.S. Tariff Commission for relief under the peril point clause of the Trade Agreements Extension Act is pending. The U.S. tariff on packaged fillets, and fillets in block form, is 1⅞ cents per pound for quota imports[19] and 2½ cents on all imports over the quota, and these specific rates have been in effect since 1939. New England representatives have argued that the rates have lost their protective character because of the increase in the price of fillets since 1939, although 2½ cents on 19-cent fillets (an average price suggested by 1955 export data) is the equivalent of an *ad valorem* rate of 13%.

In the North American food market, fresh and frozen fish of all kinds, including fillets, probably come more closely into competition with agricultural protein foods than do any other fishery products. In spite of this, however, there does not seem to be any significant relationship between the consumption of fillets and, say, meat supplies, or between the price of fillets and the prices of meat and poultry (Fig. 15). To some extent the short-run changes that might be expected in these relationships may be obscured by the buffer effect of stocks held in storage. While extended storage of frozen fish is not desirable, it is well known that quantities have been held for 12 months or more in times of long supply or weak demand. Stocks may be run up rapidly, as in 1953, and almost as quickly run down when conditions change.

The combination of certain features which seem to be associated with groundfish fillets, i.e. relative price stability, except in periods of crisis, a small average *per capita* consumption of about three pounds and abrupt stock fluctuations, all suggest the presence of a unique market for these products which appears capable of accepting a rather specific quantity — without too much reference to price — but is not elastic when it becomes necessary to sell unusually large supplies.

The future demand for Canadian groundfish fillets depends to a large extent upon the market that may be provided by the population of the United States. The projection of the trend line which is based upon consumption[20] and population in that country from 1949 to 1955 results in a statistical projection of consumption of 500 million lb. by 1980 (Fig. 26). A figure of this magnitude does not seem to conform to the realities of the present marketing position, which is marked by intense competition in the sale of these products, both in Canada and in the United States. If the 1980 projection is converted to a *per capita* figure, however, the forecast is at least within the bounds of possibility: 2.3 lb. against 1.5 lb. in 1955. There are some grounds for accepting a *per capita* increase of this magnitude as a rough indicator of the future consumption of these products in the United States. For example, there has been a very marked upward

trend in the use of frozen foods in homes and restaurants; refrigeration facilities are constantly being improved and expanded not only by the wider coverage provided by commercial facilities in smaller cities and towns, but also by the adaptation of deep-freeze units in the homes; restaurant eating is becoming more popular in both Canada and the United States, and there is evidence that the restaurant market is an important outlet for fresh and frozen fishery products. If this particular trend continues it should be accompanied by a commensurate growth in demand for these products.

An additional consideration in this connection is the possibility of enlarging the market for fresh and frozen fishery products by enlisting as fish consumers that substantial part of the population in the United States which does not, apparently, now consume these products by reason of family habit or custom. This matter has not been investigated in the United States in its own right, but studies of consumer preferences contain information which strongly suggests that this is the case.[21] The extent to which the fish trades may be able, in the future, to interest this potential market in their products is quite uncertain but the uncertainty does not minimize the significance of this part of the population in future fish consumption trends.

Despite the evidence, statistical and other, which seems to support a projected demand in the United States of the order of 500 million lb. of groundfish fillets, the figure that was settled upon as an adjusted estimate was 400 million lb., giving a *per capita* rate of 1.5 lb. To some extent the reduction was suggested by the uncertainty about the duration of the 1949-55 consumption trend in the United States, which has undoubtedly been influenced by the introduction of fish sticks in 1953. This new product is a convenience adaptation of the traditional fillet based upon the plant preparation of portions which are dipped in batter and frozen, or dipped in batter, cooked and frozen. Sales of fish sticks in the United States are estimated to have reached 65 million lb. in 1955 and included, as raw product, a considerable quantity of blocks, i.e. fillets frozen together, of Canadian origin.[22]

The introduction of fish sticks in the United States undoubtedly provided an indirect stimulus to the consumption of groundfish fillets, but not to the extent that the absolute sale of sticks would suggest, because they replaced the ordinary fillet to some extent. In addition, by the end of 1955 the demand for fish sticks in the United States seemed to have been matched by supply, and considerable concern was exhibited by the trade about future prospects for this commodity as prices began to weaken. Both optimistic and pessimistic opinions have been expressed publicly concerning prospects for fish sticks in the United States, with the optimists arguing that rigid standards covering quality and packaging will restore them to their former competitive position. This may happen but it seemed the better part of valour to deflate the 1949-55 trend somewhat to compensate for the

special, and rather concentrated, impact upon the demand for fillets attributable to this new product.

A more difficult question is posed by the necessity of estimating the significance of this projection of U.S. demand for the Canadian groundfish industry. The problem is complicated by several considerations: the common property nature of the resource, the future prospects for the New England industry and the competition that may develop in this market from the production of Iceland, Norway or other countries. Again it is necessary to turn back to the immediate past as the only possible guide to the future. The Canadian industry has taken an increasing share of total fillet exports to the United States in recent years — 65% in 1953, 62% in 1954 and 75% in 1955 — while exports from Iceland and Norway have declined both absolutely and relatively. In 1955 the New England industry produced 75 million lb. of frozen fillets from domestic landings, and an unknown quantity of fresh fillets. If it is assumed that this level of production is continued into 1980, which is a dubious assumption, the imports required to supplement domestic output in meeting the projected demand are of the order of 300 million lb. and 75% of this figure — Canada's recent share — is 225 million. Thus, on the basis of this arithmetic, the share of the market that might be taken by Iceland, Norway and other exporting countries would be 75 million lb. The largest imports from these countries took place in 1954 when the total was about 50 million lb., mainly from Iceland, but there is no reason to believe that this quantity could not be increased substantially if the demand existed, and if raw fish were available for filleting in these countries. A "safe" figure has been suggested for Canadian exports of 175 million lb., not on the basis of any particular economic considerations but simply to take cognizance of all the uncertainties that are associated with such forecasts.

The projection of the 1949-55 trend of Canadian consumption (Fig. 23) gives a statistical forecast for 1980 of 107 million lb. The correlation is not very satisfactory and the adjusted estimate of 85 million lb. is based more upon general considerations than it is upon the statistical projection. Consumption at this level in 1980 would provide a *per capita* rate of 3.2 lb., which is about half a pound per person more than the present rate. This is an increase of a small order in 25 years, but future estimates are subject to the same qualifications that were noted in connection with U.S. demand for these products. On balance, there appears to be more reason for lowering the statistical estimate than for accepting it, especially in view of the question raised by the competition that may occur between the two markets in the future.[23]

Lobster marketed in the shell or in the form of shucked meat presents a special case in the group of fresh and frozen products. The particular demand which exists for this species in North America, the United Kingdom and some other Commonwealth countries is well attested by the price which

it commands from consumers. On this continent, lobster (except canned lobster) can hardly be considered a household food commodity. Consumption is generally associated with the more expensive clubs and restaurants, where a meal featuring lobster is likely to be the most expensive item on the menu. The demand to which this price level is related probably depends to a large extent upon the taste of lobster flesh, but to some extent it is also a matter of conspicuous consumption.[24]

This demand is associated with a restricted supply. Lobster fishing is subject to conservation regulations on both the New England and Canadian Atlantic coasts. For some years now, the annual catch is considered to have been close to the maximum quantity possible on a sustained yield basis. The volume landed in Canada may be increased if fishermen continue to turn towards the retention of market sizes which are heavier and more valuable than the canner size,[25] but the increase in landed weight that may result from a trend of this kind is probably not large. The stable character of landings over the last few years is reflected in the projection of the demand for this species by 1980. The trend which results from a projection based upon the years 1949 to 1955 is obviously dominated by the relatively inflexible supply position and gives practically no clue to the limit imposed on consumption by demand. It is the price level attained by this species, in relation to other fish and to meat, that indicates most clearly the special nature of the demand for the various forms.

The increase in population and income anticipated in North America in the next 25 years will have a special significance for this species insofar as price behaviour is concerned. At the present time, a temporary reduction in fishing effort caused, for example, by rough weather conditions results in the kind of scarcity price that developed in April, 1956, when the price for market lobsters in western Nova Scotia reached 85 cents a pound at the wharf. Under pressure of a much larger and wealthier population, the long-run prospect is one of steadily increasing prices for the products of this species relative to other foods. The probability that the price of lobsters in the shell will move upward in the future is a matter of considerable importance for the competitive position of the canned form. The supply of raw product for the canneries will depend upon the price which can be offered for "canner" lobsters in relation to that for "markets", and it is doubtful that the canning trade will be able to meet the competition that may result from shell prices if present trends continue.

In this connection, there does not appear to be any significant substitution of other commodities for shell lobsters or lobster meat. There was some concern a few years ago that canned and frozen rock lobster tails, produced in the Union of South Africa, might provide serious competition for Canadian lobsters but, apparently, that has not been the case. Canadian imports of canned lobster from the Union reached 120 thousand lb. in 1953 but dropped back to about 70 thousand lb. in 1954 and 1955. Beginning about

the same time (1950), difficulties began to be experienced in the market for Canadian canned lobster and production went down from 68.4 thousand cases in 1950 to 58.7 thousand in 1952. It is probable, however, that the marketing problems associated with this product were due as much to internal conditions as to competition from outside the country. The production of lobster meat doubled from 1948 to 1954 and provided serious competition with canned lobsters for raw material, because it is relatively cheaper and more adaptable to restaurant methods for the quick preparation of salads and sea food dishes. At the same time, some resistance was noted to the price for canned lobster in the export markets, especially with the appearance in the same markets of canned crab products from the U.S.S.R. and Japan.

The present system of conservation seasons on the Canadian Atlantic Coast has developed into an institutional pattern of production which tends to resist changes in market requirements. The assignment of particular seasons, and particular sizes, to specific regions dictates the supply for all forms throughout the season. While there has been a significant development of pools or pounds for the assembly and holding of live lobsters prior to marketing, there is still a marked seasonal pattern in landings, exports and price. As far as the U.S. market is concerned, this seasonality of Canadian supplies is reinforced by a similar pattern in domestic production in that country. Canadian exports to the United States and Maine landings normally reach a common peak in June and July, when supplies are three to four times as great as in the short season (Figs. 29 and 30). The supply pattern is matched by the usual seasonal variation in prices to producers, but this is not carried over into the retail price level where, as with many other fishery products, the intervention of importers, brokers and wholesalers brings about a considerable ironing-out or damping of the variation in primary prices.

The United States dominates the market for Canadian lobsters in the two important forms, shell and meat, and presumably there are only a few urban markets in this country — Montreal and Toronto, for example — that can compete for the supplies of this high-priced product. To what extent this situation may be changed by the potential growth of the Canadian market over the next 25 years, it is impossible to say. At the present time, there is no tariff impediment in the way of exports of Canadian lobster to the United States — whether in shell, as meat or canned — and the development of future trade will depend upon the interplay of natural competitive forces. The market in the United States for lobsters and other fishery products has the advantage compared with the domestic market, of volume sales — a major consideration that may outweigh even price differences in Canadian commercial policy.

Salted and Dried

Salted cod always has been in greatest demand in warm countries that are basically agricultural and that, generally, are characterized by relatively low average income levels. The important markets are the Caribbean and South American countries and those which border the Mediterranean. As a result of developments outlined later, the former group of markets has become of primary concern to Canadian salted fish exporters. It is expected that by 1980 the Caribbean markets will absorb a much larger percentage of the exports of salted cod from this country than they have up to the present.

In 1955, exports of salted cod and related species to the three chief Caribbean markets — Puerto Rico, Cuba and Jamaica — represented approximately 65% of the total Canadian exports of these products to markets in the Western Hemisphere and about 50% of the total exports of salted groundfish to all markets. Canadian exports of salted cod and related species to the three largest Caribbean markets will probably comprise close to 75% of the total by 1980.

Total imports of salted groundfish into Puerto Rico, Cuba and Jamaica from all sources are expected to increase between 1956 and 1980, but at a diminishing rate. By the end of the forecast period, these countries may be importing annually a total of 90 million lb., product weight, of salt cod and related species. Canada's share in 1955 represented 80% of their imports of salted groundfish, or 35.5 million lb. for the three countries. Should Canada be able to maintain its present position in the salted fish markets of Puerto Rico, Cuba and Jamaica, its export trade in salted fish to the three countries will total in the neighbourhood of 70 million lb. by 1980. In addition, Canadian exporters sell significant quantities of salted cod, pollock and hake to a number of lesser Caribbean markets. This trade totalled 18.5 million lb. in 1955. Exports to these markets are expected to increase slightly by 1980, with the result that they may total 20 million lb. The Caribbean area, then, may absorb approximately 90 million lb. of Canadian salted groundfish by 1980.

For many years Brazil has been one of the principal importers of salted fish and prior to World War II, Newfoundland was a major supplier, particularly for the market in northern Brazil. Canadian exporters in recent years have been unable to sell salt fish to Brazil, but by 1980 there is at least a chance that the Brazilian market may be taking the Canadian product once again, possibly as much as five million lb. per year.

The United States is a somewhat specialized market for Canadian salted groundfish since it imports largely boneless dried fish and wet salted fish for boneless production. Canadian exporters sold 15 million lb. of salted groundfish to the United States in 1955, but this trade probably will decline to about five million lb. by 1980. The current cost-price

relationship in boneless salt fish production in the mainland Atlantic Provinces leads to the belief that this phase of the industry will decline in importance. The price of boneless salted cod is substantially higher than that of the traditional types but not sufficiently so, apparently, to offset the extra costs that are incurred.[26] In addition, of course, the boneless trade will be subject to the same raw material considerations that will apply to the whole salt fish industry in the future.

The Mediterranean markets, where Newfoundland's light salted dried fish and the Gaspé cure traditionally have been favoured, are declining in importance so far as Canadian exporters are concerned. Canada exported 15.2 million lb. of salt cod to European countries in 1955, but this trade probably will decline substantially in the next 25 years.

The total Canadian export trade in salted cod and related species is thus expected to follow the downward trend apparent in recent years and may reach the neighbourhood of 100 million pounds, product weight, by 1980, as compared with 125 million pounds in 1955.

The above projections are based upon a number of premises which are outlined below. These are of primary importance when applied to the Caribbean area. The possibility of technological development in the salted fish industry which might evolve products capable of opening new markets or of expanding present markets, the expansion of domestic fishing industries and the growth of refrigeration facilities in the Caribbean countries are among the factors most difficult to assess.

Statistical data on world production and trade in salted groundfish during the recent past provide some basis for forecasting the future of the industry (Tables II to IV). The world production of salted cod and related species in 1954 totalled 610 million lb. dried weight and the total in 1955 was somewhat higher. The five-year, 1950-54, annual average was 631 million lb., as compared with 458 million lb. for the 1945-49 period and 511 million lb. for the 1935-39 period. Reduced production during the immediate postwar period resulted from the necessity for rehabilitation in the fishing industries of countries devastated by war. Only Newfoundland, Iceland and Norway, among the major producers, had a smaller output of salted fish in 1954 than in 1939, while Portugal and Spain produced much more than in 1939.[27] Between 1948 and 1954, production in both Newfoundland and Canada's mainland provinces declined. Iceland, Norway, Portugal, Spain and France showed pronounced production increases in the same period.

Imports of salted cod and related species into the principal importing countries in 1954 totalled 319 million lb., compared with 366 million lb. in 1948 and 402 million lb. in 1938. An important factor in the decline of this trade is the rise in the national production of Portugal and Spain which has enabled those countries, net importers of salted fish,

to reduce their dependence upon foreign supplies. Total consumption of salted cod in Spain in 1954 was below pre-Civil War levels but was greater than in 1950. Consumption in Portugal in 1954 was considerably above pre-World War II levels.

The Caribbean and South American countries, unlike the Mediterranean countries, have never developed fishing fleets designed to exploit the resources of the North Atlantic. Historically, they have imported their supplies of salted groundfish as part of a reciprocal trade pattern that included exports of sugar, molasses and rum. The four major markets for salted fish in the Western Hemisphere, Brazil, Puerto Rico, Cuba and Jamaica, together imported 140 million lb. of salted cod and related species in 1955, compared with 109 million lb. in 1948.

Per capita consumption of salted groundfish has declined in some of the major markets and risen in others in recent years as the following table indicates.

Per Capita Consumption of Salted Cod and Related Species in Principal Markets[28]

(in lb.)

	Portugal	Spain	Brazil	Puerto Rico	Cuba	Jamaica
1940	11.6	1.2	0.9	No data	2.6	9.5
1950	15.0	3.2	1.1	14.3	4.9	7.0
1951	15.0	4.2	1.7	14.9	5.0	8.5
1952	12.9	4.2	0.9	14.4	4.5	7.4
1953	14.8	4.1	0.6	12.1	5.2	9.2
1954	14.6	3.7	0.8	15.9	4.7	10.3
1955	15.7	4.5	1.0	13.9	4.7	11.2

In addition to the trends in consumption suggested by these data, the question is also raised as to the importance of salted cod in the diet of the populations. Normally this commodity has been regarded as a source of protein complementing the animal protein available from the indigenous livestock industries. It is probably true that salted cod has an important dietary function for some groups in the populations concerned. For others it is more likely that its main contribution is that of a condiment which gives a special flavour to the bland vegetable foods which supply the energy and vitamin requirements of the low-income groups. Even in the high *per capita* consuming countries, like Portugal and Puerto Rico, the quantities of salted cod consumed represent about one-tenth of the animal protein consumption in North America. It is unfortunate that no consistent data are available on the consumption of meat and fowl in these countries that would permit a comparison of the relative contribution of fishery and meat products to the protein intake of the populations. It is probably not realistic

to compare the diets of these Caribbean people with those of North America, except to suggest that salted fish is not likely to be so substantial a source of animal protein.

In the case of Spain, Brazil and Cuba, the *per capita* figures are so low as to suggest a) that they are not true "per capita", i.e. that the consumption is not related to the entire populations but is restricted to parts of the population, or b) that as true "per capitas" they indicate that this commodity is used as a flavouring. The quantities that must be consumed per week are extremely small: in Cuba, for example, the 1955 annual rate of 4.7 lb. per person equals 1.4 ounces per week. It has been observed that the agricultural workers in the Caribbean countries purchase quite small amounts of salted fish, perhaps four ounces at the most at any one time, presumably for use by a family. These observations suggest very strongly that a portion of this quantity must serve largely as a condiment to flavour the stewed or boiled vegetables that represent the bulk of the meal.[29]

In the light of the scanty information that is available on this subject, it would appear that salted fish has two distinct uses in the diets of the principal consuming countries: the first as the full protein base of a meal and the second as a flavouring associated with the vegetable diet of low-income population groups. To the extent that this is true, it has obvious implications for the future demand for salted fish in the principal markets. For example, the second or condiment use might be expected to decline with any rise in real wages. The meal base use will eventually face competition, perhaps in the Caribbean countries first, from agricultural foods derived from indigenous or imported sources.

By 1980 the *per capita* consumption of salted groundfish probably will have declined from current levels in the principal markets of the Caribbean area and South America. The upward trend in population is expected to continue, at an accelerated rate in the British West Indies, at a constant rate in Brazil and Cuba and at a reduced rate in Puerto Rico, where there is already a serious overpopulation problem. There is evidence of a positive correlation between increases in population and increases in salt cod consumption in Puerto Rico, Cuba and Jamaica during the past few years (Figs. 31 to 33). Under perfectly free marketing conditions, and barring any fundamental change in the economies of those countries, this probably would continue to be the case. These conditions do not apply, however, and the ratio of increase in effective demand for salted groundfish to increase in population is likely to diminish in each of the markets.

Certain characteristics of the demand for salted fish in Caribbean countries are of greater importance than others. Chief of these is the response of demand to fluctuations in the disposable income of the agricultural labourer and its dependence upon the prosperity and continued importance of the manual worker. The Caribbean countries and Brazil are

basically agricultural, their earnings of foreign exchange being derived largely from partially processed products such as sugar and coffee, bananas and cotton. There is evidence of a positive relationship between total sugar production and the consumption of salted cod in Cuba, Puerto Rico and Jamaica since the end of World War II (Figs. 34 to 36). The relationship is most marked in Jamaica and Cuba and is apparent also in Puerto Rico. The competitive position of the cane sugar industry in the islands is affected both by failure to keep pace with modern technological developments and by the growing production of beet sugar in other countries. The continuance of quotas on the Caribbean sugar industry is likely to result in a tapering off in production. This factor, along with a static production of coffee and the other principal agricultural products, points to a declining *per capita* consumption of salt cod in the Caribbean countries.

Consumption of salt cod in Brazil is expected to decline by 1980 as the result of another factor. The positive correlation between exports of coffee and the consumption of salt cod in Brazil is limited (Fig. 37). Brazil's exports of coffee, her principal means of earning foreign exchange, have varied comparatively little since before World War II. The country's salted cod consumption has fluctuated much more widely from year to year. The demand for this commodity in Brazil, as determined primarily by disposable income generated in the agricultural industry, is not free to reflect itself in the quantities imported. Brazil's foreign exchange difficulties, which have been only partially mitigated by bilateral barter trade agreements with Norway, the current major supplier of salted and dried cod, have made the product increasingly expensive. These problems may not be resolved for some time and salted cod, therefore, is likely to decrease in importance as a staple in the diet of the Brazilian labourer.

The development of the manufacturing, mining and petroleum industries in the Caribbean countries is a factor closely related to disposable income. Industrial development is most advanced in Puerto Rico and, to a lesser degree, in Cuba, while it is becoming increasingly significant in Jamaica and the other British West Indies. Agriculture in these and other Caribbean countries has not shown the progress apparent in other industries and its relative importance has declined during the past few years. As expansion of industry takes place, labour is drawn from agriculture to the cities where wages and standards of living are higher. This type of population movement is currently taking place in Puerto Rico at the rate of some 20,000 per year. Increasing efficiency in agriculture, with the resultant reduced labour requirements in that sector, contributes to the movement to the cities. The urban worker with his increased standard of living buys more of the higher priced protein foods and consumes less salt fish than does the plantation worker. The liking for salted cod is probably not sufficiently strong to maintain past consumption levels when income rises.

Up to the present, demand for salted groundfish in the Caribbean markets has tended to be inelastic as to price. This was the general conclusion reached by G. M. Gerhardsen,[30] and by S. Bates and W. C. MacKenzie in their investigation of the salted fish trade.[31] These studies concluded that over a short period of time a rise in the price of salted cod may result in a substitution of competitive protein food products, especially in countries which are basically agricultural. Within a certain price range substitution for salted cod is not significant but if either the upper or lower limits of this range are exceeded substitutability with competing foodstuffs may result in a marked change in effective demand.

Over longer periods of time there appears to be little relationship between price and the production and consumption of salted cod. The average unit value of exports of salted cod during the interwar period declined for almost all producer nations, the downward trend being most pronounced after the late 1920's. During this period of generally falling prices there was no pronounced decline in total world production of salted cod. There was a tapering off in total imports, however, with overproduction resulting during the 1930's. The salted fish industry failed to react to declining prices in a normal way partly owing to steps taken by governments in producing countries to protect it.

The World War II period was an abnormal one in the salted fish industry. The experience of the years following the conflict are of greatest interest in forecasting future developments. Throughout the postwar as in the prewar period there has been no apparent relationship between price, production and imports. Total world production of salt cod and related species from 1947 to date has never fallen below 440 million lb. In fact, production dropped below 550 million lb. in only one year, 1948. Imports by principal markets have been consistently above 309 million lb., somewhat lower than the average of the 1930's. Several of the major consumer nations have increased their salt fish production markedly. Total world stocks of salt fish at year end have not been excessive, even following the peak production season of 1952. There has been no significant overproduction since the end of the war. General price levels for salt cod which rose during the war have remained fairly constant, despite rising prices for most competing foods (prices paid for Canadian salted fish have declined). Thus, salted cod prices in constant currency units generally have declined. Yet production in recent years has remained consistently high and imports have shown no tendency to increase.

Postwar developments in the Caribbean salted fish markets support the belief that effective demand, when translated into imports, tends to be inelastic as to price. The governments of Puerto Rico and Jamaica in recent years have imposed ceilings on the retail prices of salted cod, and these countries may be considered controlled markets. Total imports of salted fish into both markets have increased rather than decreased during the period of controls.

Cuba is a free market and competition here — between Canada, Norway and France principally — has resulted in generally constant price levels for salt fish, although imports have tended to increase. In these three markets price has not played a significant role in affecting imports.

The trade in salted fish in almost every major importing nation is under some degree of government control. The net effect of these controls in most cases is not to restrict the total trade but to redistribute supplies on the import markets among the various producers. Canadian exporters have been adversely affected in this way in Brazil and the Mediterranean markets. In Caribbean markets, artificially imposed price levels have not had a significant effect but recent government action of a different nature in the British West Indies, for example the listing of salted cod under Open General Licence in 1954, has had the effect generally of increasing imports of salted cod.

Brazil's imports of salted cod in recent years show clearly the effect which government control can have in determining the pattern of trade. The trade imbalance between Canada and Brazil, particularly during the past three years, has forced Brazilian authorities to make dollars so expensive to salted cod importers that Canadian exports of salt cod to that country have ceased. The slack in Brazilian imports which has resulted has been taken up in part by Norway, Iceland and Denmark, which have either barter agreements or favourable trade balances with Brazil. In addition to the redistribution of Brazil's salted cod imports, the marked fluctuation in total imports from year to year indicates both the hazards inherent in barter agreements and the problems of a country dependent for most of its foreign exchange upon agricultural exports which fluctuate greatly in price.

Under the present conditions of international trade, therefore, the importation of salted fish is dominated by government controls of one kind or another, although price controls are of minor significance. The introduction of free trade and convertibility of currencies obviously would greatly affect the international trade in salted fish but such developments are but matters of conjecture at the present time. Government controls will almost surely continue to affect Canada's salted fish trade with most countries. It is probable that, with the federation of the British West Indies, any controls introduced by British Caribbean governments will not discourage over-all demand for salted cod and will benefit the Canadian exporter. The prospering economies of Cuba and Puerto Rico are not expected to necessitate the imposition of restrictive controls. Brazil's exchange problems, as already indicated, are expected to remain for some time and, although total imports of salted cod probably will decline, the possibility of re-establishing some proportion of the former Canadian trade cannot be ruled out.

The factors affecting demand for salted cod and, consequently imports into the principal Mediterranean markets — Portugal, Spain, Italy and Greece — are the same as those applicable in the Caribbean, but their im-

portance differs. The import trade in salted cod in the European markets is subjected at present to stricter government control than it is in the Caribbean countries, particularly where imports from hard currency countries are concerned. It is expected that this situation will continue and will result in a continued decline in Canadian salted cod exports to Europe. Portugal, Spain and to a lesser extent Italy, like Brazil, have experienced a dollar shortage since the end of World War II. Exchange controls and the expansion of fishing effort in the first two countries have severely curtailed imports of salted cod from Canada in recent years. A continued flow of exports, in greatly reduced volume, from this country has been made possible only through bilateral negotiation. It is true, of course, that the total flow of salted cod imports into Portugal, Spain and Italy has not been affected by exchange controls, as soft currency countries have taken up the slack.

The substitutability of other fishery products and quality and size preferences are more important in the Mediterranean than in the Caribbean markets. The possibilities of substituting other fish products, such as indigenous and imported frozen forms, or meat products for salted cod are less limited by such physical factors as inadequate refrigeration facilities. The European consumer of salted cod has well-defined tastes and exporting countries must meet quality and size requirements. Such an apparently unrelated factor as a short supply of olive oil results in a decreased demand for salted cod because many consumers require the oil to be used in the preparation of salted fish dishes.

The import trade in salted cod is more responsive to price fluctuations in the Mediterranean markets than in the Caribbean. Competition among exporters for the European trade is more rigorous than in the Latin American countries. France, of the principal salted cod exporters, is in a particularly favourable position geographically to compete in the Mediterranean markets. In general, however, the principal effect of price changes is to shift the pattern of trade, rather than to affect the total volume of imports. An increase in price levels is reflected, particularly in Spain and Portugal, in increased production by the domestic industry to facilitate a reduction in imports.

On the other hand, disposable income as a factor in determining effective demand for salted cod and imports is less important in the Mediterranean markets than in the Caribbean. The former countries — particularly Italy — while basically agricultural, have developed fairly diversified economies. As a result, average income levels are generally higher and more stable than in the Caribbean area.

Fish Meal

The bulk of the fish meal manufactured on the Canadian Atlantic Coast is a by-product of groundfish filleting operations. On the Pacific Coast, meal

is produced mainly as a joint product with oil in the herring reduction industry. About three-fifths of the current production of fish meal is obtained from the operations of processing plants in British Columbia. The market for fish meal produced in this country is determined by the total available stocks and the prices of competitive high-protein feed concentrates in North America, and to some extent by the world supplies of such products. The available supplies of high-protein feeds in Canada during recent years has approximated 500 thousand tons, of which fish meal accounted for about 5%. These feeds are substitutable, within limits, and the strength of the market is therefore determined by the over-all supplies of high-protein concentrates.

High-Protein Food Supplies, Canada, 1954

Kind	Weight tons	Percentage of Total
Soybean meal	203,400	39.5
Packing house by-products	93,400	18.2
Brewers' and distillers' dried grains	67,000	13.0
Linseed meal	53,300	10.4
Fish meal	26,600	5.2
Miscellaneous	70,900	13.7
Total	514,600	100.0

In addition to the known nutrients present in fish meal, there are also nutrients which have not yet been isolated and identified. These are currently referred to as growth factors and are of great value in livestock feeds. Since little is known about these growth factors, or about the extent to which they are present in competitive feeds, it is not possible to state whether their existence in fish meal will improve the demand for this product in relation to competitive protein feeds. Fish meal is a high-quality product and it is logical to assume, therefore, that it will at least hold its present competitive position in the market.

It is anticipated that the production of livestock and livestock products in Canada will approximately double during the next 25 years. During the same period, animal production in the United States is expected to increase by about 45%. If an allowance of 20% is made for such technological advances as improved animal selection, improved feeding methods, etc., then the demand for Canadian fish meal will increase to at least 84 thousand tons annually by 1980. Domestic requirements under these conditions would approximate 40 thousand tons and 44 thousand tons would be necessary to meet the anticipated demands in the United States. In arriving at this estimate, it is assumed that the present cost-price structure of the fish meal industry will remain about the same in relation to substitutable supplies of competitive high-protein feeds and that technological advances in fish catching and rendering will take place at the same rate as in competitive industries.

The greatest increase in fishmeal production is anticipated to be derived from the fisheries of the Atlantic Coast. It is estimated that the total annual landings of cod and related species (including redfish) in 1980 will be about double the present volume. The resultant offal and scraps would probably support an annual increase in fish meal production of about 20 thousand tons. The current trend towards fewer and larger fish plants should lead to a significant reduction in the present wastage of scraps and offal. Total annual production from this source, therefore, should approximate 38 thousand tons by the end of this period.

The greatest potential supply of fish meal, namely the large stocks of Atlantic herring, have remained virtually untapped up to the present. Recent investigations have failed to reveal sufficient data relating to the movements of this species to indicate whether they may be caught in a volume and with a degree of certainty that would make it profitable for large amounts of the necessary capital to be attracted to the fishery, and several attempts to establish such a fishery have failed.[32] If it is assumed that the catch of Atlantic herring for reduction purposes remains at about the current level of 3.5 thousand tons, the total production of fish meal in the Atlantic Coast provinces should approximate 42 thousand tons by 1980.

A large increase in fish meal production is not anticipated on the Pacific Coast during the period 1956-80. The general improvement in the demand for this product could result in an increase of about five thousand tons of herring, with a total annual production of about 32 thousand tons of herring meal at the end of the period in question. The anticipated growth of the Pacific salmon fisheries may provide an additional two thousand tons of meal annually from waste and offal. As a result of these activities, the manufacture of fish meal in British Columbia may increase from the current level of 31.6 thousand tons to perhaps 40 thousand tons by 1980.

Current and Anticipated Fish Meal Production, by Regions

(thousands of tons)

Kind	Current Production (1949-55 av.)			Anticipated Production 1980		
	Atlantic	Pacific	Total	Atlantic	Pacific	Total
Herring	3.5	27.3	30.8	3.5	32.5	36.0
Cod and other groundfish	17.8	—	17.8	38.0	—	38.0
Salmon	—	1.7	1.7	—	3.5	3.5
Other	—	2.6	2.6	—	2.5	2.5
Total	21.3	31.6	52.9	41.5	38.5	80.0

Thus in 25 years' time the total annual production of Canadian fish reduction plants might reach 80 thousand tons, to meet an estimated total demand of 84 thousand tons. Under such circumstances, fish meal would remain in relatively strong demand in the feed manufacturing industry.

Marine Oils

The demand for medicinal fish oils has been virtually eliminated by the development of synthetic vitamins. The market for other marine oils is characterized by two important features: a) a wide range of oils and fats that are substitutable to a large extent, and b) a high degree of concentration in the oil using industry. Normally, marine oils constitute slightly more than 5% of the total industrial consumption of fats and oils in Canada, and less than 5% in the United States. In Europe, however, these oils are much more important in terms of over-all usage. In recent years, the principal outlet for Canadian fish oils has been the soap manufacturing industry. Marine mammal oils are suitable for use in the manufacture of shortening and margarine but an established preference for vegetable oils, based upon "product differentiation", has served to restrict the use of marine oils for these purposes in Canada and the United States at the present time.

In almost all uses, fish and other marine oils compete with vegetable oils and animal fats. The supply of these is subject to wide variation unrelated to demand conditions, arising in part from the fact that several of the vegetable oils, e.g. cottonseed oil, and most of the animal fats, e.g. rendered lard and tallow, are by-products of industrial processes or produced in necessary conjunction with other commodities. The effective demand for marine oils thus depends on the production, and indirectly on the price, of such things as cotton, soybeans, meat, etc. Consequently, the market is characterized by a considerable degree of instability.

A large proportion of the total supply of marine oils is produced as a joint product with fish meal. As a result, production of the two groups of commodities is likely to follow similar trends. Since the oil content of different species of fish varies considerably, however, a change in the production of fish meal does not necessarily result in a proportionate change in marine oil production. If the existing cost-price relationships of marine oils to substitutable products continues, it is anticipated that the production of marine oils in Canada will increase from the current level of about 40 million to approximately 60 million lb. per year by 1980.

6

PROSPECTS FOR DEVELOPMENT

THE ECONOMIC prospects of Canada's fisheries may be presumed to be concerned, in the first instance, with the wealth or well-being of the people who gain their livelihood in that industry. They are concerned also with the contribution that the fisheries may make toward the prosperity of the economy as a whole.

The prospects for the fisheries depend, in part, on the supply of and the demand for fish products. The outlook for supply and demand is explored extensively in the earlier discussions of resources and markets. To bring that twofold analysis to a single focus, it needs perhaps only to be pointed out that if economic prospects are to be favourable these supply-demand (or cost-price) relationships must be such that they will encourage the exploitation of the particular fish resources. But in a broader sense, while a suitable supply-demand relationship may be a condition necessary for favourable economic prospects it is seldom a sufficient condition and other conditions may have an important influence on such prospects. In other words, while a favourable price and profit situation may encourage economic activity in the fisheries, other conditions may be more important in bringing about or creating that activity. In short, a favourable price may be most commonly in the nature of a limiting factor rather than a generating factor as far as economic activity, particularly economic development and improvement, is concerned.

As an example, many fishing settlements have been by-passed by the economic development that occurred during the war and postwar period in the rest of the economy. The economic prospects for people in such settlements may appear poor in spite of a relatively favourable price for fish products. This is because the economic prospects for these fishermen are closely related to other conditions: their prospects may depend chiefly upon their opportunities and initiative in equipping themselves with more productive fishing equipment, or moving nearer to a market in which they can dispose of a larger catch, or both. They may depend largely on the level of employment in the rest of the economy and thus

on the alternative or supplementary employment opportunities available to men with their aptitudes and skills. They may depend on the effectiveness of entrepreneurship in organizing the assembly and processing of fish products. Finally, their economic prospects may depend upon social institutions, such as ownership of resources or material agents, and upon the technology available. Fortunately, in the case of many of Canada's fishing areas, these other conditions on which economic prospects depend are, in the main, like prices, relatively favourable.

In general, the conditions basic to economic growth in the fisheries of Canada appear to be propitious. On the one hand, the extent and character of the resource base indicates that there may be substantial opportunities for an expansion of the supply of a number of important species. On the other, Canada's population is expected to increase by two-thirds during the next 25 years and the demand for many of the major fish products appears likely to increase proportionately at least. A significant backlog of unused or only partly used technology holds possibilities for greatly increasing the productivity per man in the fisheries, of improving the quality of fish products and, at the same time, increasing the profitability of both fishing and processing.

In the main, the economic prospects of the fisheries seem likely to be closely related to prospects in the rest of the Canadian economy and, to some extent, to prospects in neighbouring countries with which trade is carried on. If, as there is good evidence to expect, the level of future economic activity remains high in the other sectors of the Canadian economy, a continued substitution of capital for labour in the primary industry can be expected as the labour force continues to be drawn out of fisheries into more remunerative employment. Thus the remaining fishermen, by using more capital with their labour, may improve their productivity and income. The form that such new capital will take may be indicated by the increasing utilization in recent years of larger and more productive vessels and gear, of mechanized gear to replace manual operations and of fish-finding and other electronic aids. At the same time, with a buoyant economy, demand and prices for fish and fish products are likely to remain high and be attractive at least to those fishermen who have improved their productivity by utilizing more capital in this way. Incomes in many fisheries, such as the Pacific salmon fishery, are likely to remain high.

On the other hand, many fishing settlements may remain relatively isolated from the economic development in the rest of the economy. In these areas, economic prospects may remain poor, even with relatively favourable fish prices, unless special measures are taken to encourage the fishermen concerned to attain a higher level of productivity than they have at present. In fact, unless the necessary improvement in productivity is achieved, fishermen as a whole may fall farther behind the rest of the

Canadian community. In some cases, fishermen in remote districts have no alternative employment with which to supplement their low income from fishing. In other cases, fishing supplements farming—as in lobster fishing in the Maritimes—and though fishing productivity may be much lower than it need be, it may often be higher than it is in farming in such areas. In both of these cases, significant obstacles may stand in the way of fishermen improving their productive position.

Technological developments that may be applied in the fisheries have been outstanding in recent years and a large backlog of improvements in equipment, techniques and products is available.[1] Utilization of this technical backlog could enable both fishermen and fish processors to increase substantially the efficiency and profitability of their operations. A few examples such as fish-finding equipment, icing-in-the-hold techniques, preservation by aureomycin and refrigerated sea water, improved and mechanized curing techniques, mechanization of filleting and skinning operations, etc., may indicate the breadth of opportunities in this field. Some of these techniques require substantial capital investment, e.g. filleting and skinning machines; others require very little, e.g. icing fish in the hold. The rate at which such technology is adopted will depend on many factors, however. Important among these are the cost and supply of labour, the cost and availability of a supply of capital, the training (and skill) needed to handle the new techniques, and the prospective profit opportunities, e.g. the length of time it will take to recover the new capital investment, the opportunity to gain advantages over competitors and the readiness and initiative of individuals in taking up new technology and new methods. These factors are examined further in the analysis below of trends and prospects in employment and capital use.

It may be necessary for Canada's fisheries to continue to utilize more of these technological opportunities if they are to maintain their position in those fisheries in which they must compete with other countries. International competition in the fisheries lying outside Canadian territorial waters involves a great many elements, including relative productivity, relative costs of fishing and transporting fish, tariffs and other protective devices, direct subsidies and other assistance measures and the value of the dried or other fish products in relation to the level of living in each country. Many of these elements operate (or have been invoked, as the case may be) against the interests of the Canadian fisheries in their competition for this international common-property resource. As described earlier, international agreements are proving a useful method of conserving many of these fish resources and of utilizing them most effectively. There are numerous other limitations on the competitive position of Canada's fishing industry and these, while serious, are ordinarily less amenable to this kind of solution. For that reason, the industry in this country may need to make full use of the above-noted technological opportunities to

maintain productivity at the highest possible level as a means of holding its competitive position vis-à-vis the fishing industries of other countries.

Finally, the economic prospects for Canada's fisheries are likely to depend to a significant degree upon the continued effectiveness of the special collaboration that has been built up between the public and private bodies that are concerned with the fisheries. This special relationship has arisen because fish resources, like some other natural resources, are of such a nature that governments have ordinarily found it desirable to retain a substantial degree of control over their exploitation as a means of encouraging their most effective use. In the main, this retention of public control is based on the difficulties and problems inherent in placing resources of this kind under private control. Private control of these resources is difficult, in the first place, because of the natural obstacles to establishing and maintaining the fixed boundaries necessary for such control. Secondly, the fish resources themselves are mobile and not naturally fixed in location as are, for example, the forest, land and, to some extent, oil resources. As a result, they cannot, ordinarily, be effectively enclosed or separated off into exclusive areas suitable for private exploitation. Thirdly, a large part of the fish resources is located in waters, e.g. international waters, over which exclusive control is not exercised by anybody, public or private. Of course, this does not apply in territorial waters, i.e. waters lying within three miles of the coast, but control of the waters in this three-mile strip gives only a limited control of a resource that can move out to sea. At the same time, as noted above, in recent years a number of countries have voluntarily agreed to a degree of joint control over certain fish resources chiefly outside territorial waters.

Because of these obstacles to private control, fish resources, with a few minor exceptions such as oysters, are ordinarily exploited as a common-property resource under public control. Such use-in-common will not ordinarily lead to the most effective exploitation of resources. This is because there is little incentive to maintain or improve the resource when other users-in-common will gain most of the benefits from such private conservation. A common result of unrestricted exploitation-in-common is that breeding stocks are depleted beyond the optimum level.[2]

As a consequence of these effects of common use, it is ordinarily recognized that public intervention must be more extensive in the development, preservation and use of fish resources than in the case of certain other natural resources. Public intervention commonly takes the form of measures to protect, expand and guide the use of the nation's fish resources. In a general sense, this intervention might be said to have the aim of using the productive capacity of the adjacent coastal and inland waters as effectively (or profitably) as possible over time. With the increasing effectiveness of fishing techniques, it is now becoming evident that virtually any stock of commercial fish may be seriously depleted by

common use if the price-cost conditions are such as to encourage such excessive use. It is because of this tendency, as well as the prospects for expanding previously depleted stocks, that governments have extended their control activities into the international field also.

It may be noted, however, that there are often particularly serious impediments to the effective public control of fish resources. In the main, these stem from the peculiar limitations of the techniques[3] ordinarily available for public control of resources of this nature. Various institutions, peculiar to the fisheries, may also provide serious obstructions to effective control.

Capital Requirements

Capital in the fisheries includes the cash, credit and productive instruments required by fishermen to make their fishing operations yield most effectively. In the primary industry, capital involves, in the main, fishing craft (vessels and boats), nets and other gear, storehouses and other equipment and facilities ashore, and the cash or credit used for operating expenses by the fishermen. In the case of the secondary or processing industry, almost all of the capital is invested in assets such as land, buildings, machinery, and in the funds required by processors for carrying inventories and other operating expenses. In the case of firms specialized in marketing fish products, the main capital requirement is for working capital to enable inventories and other marketing costs to be financed.

There are nearly 30,000 primary fishing enterprises in Canada, ranging in size from a one-man operation to divisions of large firms operating fleets of vessels. The assets or capital stock of the industry are valued at approximately $124 million. In 1953, this capital was distributed roughly as follows:

	Sea Fisheries		Inland
	Atlantic	Pacific	Fisheries
No. of enterprises	23,000	4,000	3,000
Capital stock ($)			
Fishing craft	31,000,000	45,000,000	5,000,000
Gear	20,000,000	6,000,000	6,000,000
Shore equipment	6,000,000	1,000,000	4,000,000
Av. capital stock per enterprise ($)[4] ...	2,500	13,000	5,000

More precisely, somewhat over two-fifths, $51.5 million, of the total primary industry investment was on the Pacific Coast. Almost a third, $38.7 million, was on the Atlantic Coast, excluding Newfoundland. The balance, about a quarter of the total, was about equally divided between Newfoundland and the inland fisheries.

The primary industry's labour force totals about 75,000 fishermen, probably not more than two-thirds of whom are dependent on fishing as a major source of income. Under these conditions, the investment per person employed in fishing varies from as little as $500 in a primitive inshore operation to probably $15,000 on, for example, a modern deep-sea dragger. Incomes from fishing show a similarly wide variation: from an annual average net of about $250 for a shareman in the small-boat fisheries of Newfoundland and Quebec to one of $5,000 or more for a skipper of an Atlantic Coast dragger or Pacific Coast purse-seiner. This variation depends upon a range of factors but appears to be closely related in most cases to the amount of capital each fisherman is able to combine with his labour. The amount of this capital has been increasing.

In the primary industry, capital investment in Canada except Newfoundland (and excluding operating capital) has more than trebled since 1943. By 1954 it exceeded $106 million (Table V). Probably half this increase can be attributed to expansion of values through inflation. Even in constant dollar terms, however, the increase in investment probably exceeded 50% over the 11-year period. For Newfoundland, dependable capital estimates are available only for 1954, but these indicate the primary industry investment to be over $17.5 million. Data for previous years, while not fully comparable with those for 1954, show that there has been substantial new investment in that province, particularly during the decade previous to 1954, though this has been partly offset by abandonment of older boats and gear.

Almost two-thirds of the fixed capital invested in primary fishing in Canada is in fishing boats and vessels, though the proportion is somewhat smaller for Newfoundland. In this field of vessel and boat investment, there has been a rapid and decided shift toward larger vessels. During the past 15 years, for example, investment in vessels (10 tons or over) has increased more than twelvefold while that for boats (under 10 tons) has increased less than fourfold (Table V). In the Maritimes, most of the increased investment has been in the larger draggers or trawlers. From 1946 to 1953, these types accounted for an increase in capital investment of $7.2 million, offsetting a decline in the investment in 10- to 40-ton vessels, mostly schooners. At the same time, the investment in small boats, i.e. under 10 tons, fell by more than $3.4 million to $19.3 million. In British Columbia, major investment emphasis in this recent period has turned toward diesel-powered vessels of 10 to 40 tons or more. The number of such vessels increased in that province by over 260 from 1946 to 1953, while the value rose from $6.8 to $22.2 million, reflecting a large increase (87) in the number of vessels of 40 tons and over.

The trend in Newfoundland, in this respect, is again not as well recorded as in other provinces, but census data for 1935, 1945 and 1951 indicate some major changes in the level of capital investment in boats

and vessels. Schooners were estimated to have declined by 1951 to about 10% of their number in 1935. Row and sail boats under 10 tons fell by two-thirds in the same period. On the other hand, investment in draggers has increased during this period.

With this general increase in the size of fishing craft the capital investment in vessels and boats has grown more rapidly than the capital in gear and shore facilities. While capital invested in gear and shore facilities has increased steadily in Canada (excluding Newfoundland) since the late 1930's — from $11.8 million in 1939 to $34.2 million in 1953 — it has increased at a much slower rate than that for fishing craft, as shown below.

	Investment in vessels and boats	Investment in gear and shore installations	Total investment
	%	%	%
1917	45	55	100
1935	59	41	100
1953	67	33	100

The effect of increased investment in larger craft has been an important factor in this relative change. But it may be explained partly also by the relative decline in shore facilities. With the larger vessels that have been built, fishermen can use the facilities of processing plants for landing and storage. Accordingly they require fewer of their own facilities than they needed with the smaller boats.

Nevertheless, fishing gear and shore facilities require a substantial capital investment. Of the $34.2 million invested under this head in 1953, $18.4 million was in the Maritimes and Quebec. Over 40% of the latter figure, i.e. $7.5 million, represented investment in lobster traps. Another 25% ($4.5 million) was in nets of various kinds and about 12% in other kinds of gear and equipment, including weirs, tubs of trawl and such. Shore facilities, valued at $3.4 million, were thus nearly 20% of the total.

Newfoundland, with relatively few lobster traps, has only a little over one-third the capital investment in gear and shore facilities ($6.9 million in 1954) of the other Atlantic Provinces. In British Columbia, this capital is composed almost wholly of gear ($5.9 million out of a total of $6.3 million in 1953), since the shore facilities utilized are in the main those provided by the processing firms—aside from public wharves and other public installations. Salmon nets (gill-nets and purse-seines) made up about three-fifths of the value of gear in British Columbia. In the inland fisheries, about two-thirds of the total gear and shore capital ($9.5 million in 1953) was in nets, while the balance was in cold storages, small wharves and sheds, and vehicles.

The above estimates do not include the capital used by fishermen for operating expenses, i.e. working capital. Although information on the

demand for working capital is not extensive, it is adequate to give a clear indication of the importance of this type of capital. The annual expenses of fishermen provide a first approximation to this. For example, the census of 1951 compiled estimates of the expenditures of primary fishing enterprises during the year that had just passed. A total expenditure of $59 million (excluding depreciation reserves) was estimated for that year, or about $2,000 for each fishing enterprise. The relative magnitude of this working capital requirement may be illustrated by comparing this estimate of $59 million with the related census estimate of total capital investment in fishing craft of $57.9 million. Other measures of the significance of working capital are given in special studies of fishermen's operations that have been made on the Pacific Coast and in the Atlantic Provinces. The latter shows that in 1955, expenses including net crew shares were on the average just over 50% of the total capital investment per boat.[5] These boats were long-liners and draggers, all relatively new and well equipped. It seems likely that expenses on such boats would be, on the average, lower relative to boat investment, than on older, less well-equipped boats.[6] In the other study, made on the Pacific Coast, the operating expenses were relatively higher. A sample of salmon gill-netter, troll and seine boats in British Columbia shows that operating expenses (not including crew shares for gill-netters and trollers) were 46% of capital investment in boats and gear.[7] If crews' and captains' shares for gill-netters and trollers were included, operating expenses for these Pacific boats would likely be higher relative to capital investment per boat than those for the highly capitalized Atlantic vessels studied.

These estimates indicate that the capital at present required for operating expenses in the whole of the primary fishing industry may be almost as great as the capital invested in fishing craft. However, as older boats are replaced by well-equipped, efficient and modern vessels, the operating capital requirements, while rising in total, may be expected to fall relative to the investment in floating equipment.

Capital in the fish processing industry is divided among about 800 enterprises which employ about 16,000 workers.[8] Most of the plants are relatively small, however, employing an average of 20 workers each. A further indication of the large number of small firms is given by the value of output. More than half the plants in Canada produced less than $50,000 worth of products each in 1954 (Table VI). On the other hand, there are a number of quite large establishments each of which processes a large output of fish products. In 1954, for example, 40 of these large plants each produced fish products valued at more than a million dollars. Together, they handled almost two-thirds of the total output of the industry in that year. Over half of them are located in the Pacific area, with the remainder divided among the Atlantic Provinces.

Except in British Columbia, the processing industry is rather widely dispersed. The location of plants along the Atlantic Coast and on the inland lakes appears to have been guided largely by the source of supply of the raw fish. In processing fish, as in processing other products where the raw material is bulky and highly perishable, e.g. milk for cheese, it has been important to hold to a minimum the distance and time between production of the raw product and its processing. Industries of this nature are the so-called raw material oriented industries, i.e. nearness to the source of raw material supply is a major determinant of the location of processing plants. The availability of power, transportation facilities, markets and market services have in the past been important but secondary considerations.

In addition, so long as fishermen were scattered widely along the coasts and used mainly small boats for fishing, flexibility in location was very limited. Under these conditions, opportunities for concentrating the supply of fish in large volume for processing were very few. The result has been that plants are mostly small, as noted above, and commonly undercapitalized. Recent tendencies for fishermen to establish their base of operations in larger settlements and to use larger vessels have greatly improved the possibilities for flexibility in this respect, and some of the concentration of processing permitted by these developments has already occurred.

The above locational limitations on the scale of plant operations and on capital investment have been reinforced by the influence of the variability of the supply of raw material. Part of this variability in the catch can usually be attributed to physical conditions, e.g. the movements of the fish stocks, the weather, etc., and part to the size and versatility of the fishing craft used. But a major influence has been the shortness of the fishing season for many species and the sharp peak in landings during that season. In general, this involves a large volume during the summer months and a small volume in winter. Thus, employment in fish processing varies from over 16,000 during the peak in July and August to about 6,000 during the February low. In these circumstances, processing firms have tended to hold capital and other overhead costs to a minimum and to meet peak load requirements by using more labour and other direct inputs, i.e. increasing variable costs. With the changes that have occurred in the past decade or two, it seems likely that, in future, less emphasis will need to be placed on minimizing overhead costs. The larger and better equipped boats now being used make it possible to fish for a longer season and on more days during each season. This may tend to reduce the fluctuations and uncertainties of the supply of fish to processing plants and thus encourage an expansion of capital investment in the industry.

As might be expected, the present investment per plant varies greatly throughout the industry. Indications are that fixed assets might average nearly $100,000 per plant, though the very large capital investment of a few plants tends to distort this average figure upward. Working capital is also a major component of the investment in processing. In this connection, working capital is particularly significant, relative to fixed capital, in the processing of products requiring very little change in form. It is, similarly, of major importance for firms engaged chiefly in the buying and selling of finished fish products where processing is only a minor or incidental activity.

For all fish processing firms, working capital appears to comprise nearly two-fifths of the total capital investment. In 1952 and 1953, for example, an estimate of capital based on the reports of fish firms for corporation tax purposes indicated a ratio of approximately 2 to 3 between working and fixed capital. Working capital averaged $47 million per year while fixed assets (land, buildings and equipment) averaged $76 million for a total of $123 million. These data probably underestimate total investment by as much as 20% or more, though the proportions of working and fixed capital may be reasonably accurate. In other words, $150 million may be close to the total capital invested in processing, with fixed assets providing probably $90 million and working capital $60 million.

If this estimated total investment of $150 million were apportioned to regions according to value of fish products marketed in 1953, it would be divided approximately as follows:

Maritimes and Quebec	$ 62,000,000
Pacific Coast	61,000,000
Inland Fisheries	16,000,000
Newfoundland	11,000,000
Total	$150,000,000

A survey of capital investment in fish processing in British Columbia as of January 1, 1956, shows total investment in that province as approximately $66 million. This indicates that the above estimates for 1953 may be reasonably accurate. In this connection it may be noted that capital investment in British Columbia might be expected to be high relative to other provinces because of the higher capitalization of fish processing operations in that province.

The survey showed further that only 65% of the investment in British Columbia was in fixed assets. On the basis of the above estimated capital distribution, this would leave fixed assets for the rest of Canada at roughly 56% of total capital and working capital at about 44%. This higher ratio of fixed to working capital in British Columbia would appear to be supported, also, by the higher capitalization of the industry there,

particularly in processing machinery and equipment. It may also be closely related to the higher degree of concentration of the processing industry,[5] much of which is located in the Vancouver area.

Prospective Demand for Capital

With this brief background showing the extent, kind and location of capital investment in the fisheries of Canada, it is possible to assess probable trends in capital investment and in the demand for capital. In the case of the primary industry, indications seem clear that prospective changes in capital are likely to be mostly in the direction of an increase in investment per fisherman rather than in an increase in over-all capital. New investment in boats and vessels, for example, is likely to tend toward larger, better equipped and more costly craft. At the same time, the steady decline in small boat numbers since 1946 may be expected to continue (Table V). The result, on balance, should be a steady increase in the investment per fisherman. This should be the outcome in spite of the fact that the capital in the small boat is commonly lost when a large vessel is purchased because, unfortunately, the capital invested in the smaller boat is in the nature of sunk costs which cannot be transferred to the larger boat substituted for it. Thus, in effect, the investment in the larger boats will be almost wholly new investment and a supply of new capital will be needed to finance their construction.

The largest supply of this capital will, of course, be needed in the Atlantic Provinces where most of the small boats are now found and where the advantages of using larger boats are more frequently evident. Equipping existing vessels with improved engines, fish-finding, communicating and other equipment may also be expected to increase the investment per fisherman substantially. If current trends in investment in larger vessels, in this improved equipment and in new and improved gear and shore facilities continue, a projection of these trends should give an indication of the probable capital needs in the future. Such a projection of recent rates of investment, based on current dollar values, indicates that new capital requirements for the primary fishing industry of Canada (excluding Newfoundland) would be at an approximate rate of $6 million to $7 million per year (Fig. 38). At this rate, capital requirements for the next 25 years would run to a total of $130 million to $150 million and investment in the primary fisheries might approximate $250 million by 1980. In British Columbia, where recent increases are indicated to be at a rate of almost $2.8 million a year, this expansion of capital appears likely to continue without serious handicaps or deficiencies in supply. In the Atlantic Provinces, on the other hand, problems of maintaining a supply of capital are likely to go hand in hand with the problem of encouraging fishermen to use capital more effectively and in larger amounts. It may

indicate the seriousness of these problems to point out that, starting from almost the same capital base in 1944, the primary industry in the Maritimes and Quebec had hardly trebled its investment by 1953, while that of the industry in British Columbia had been almost quadrupled. In other words, during this ten-year period, the average annual investment in the Maritimes and Quebec was only about 65% of that in British Columbia.

In the secondary industry, capital development appears likely to be as significant as in the primary industry. The data needed to project long-run capital trends are not as satisfactory in all cases, however. At the same time, there is good evidence that the recent levels of new investment in the Atlantic Provinces will continue and a clear trend is evident from the data supplied in the survey of firms in British Columbia, already referred to. The B.C. processing industry is largely mechanized and developed for a relatively high and efficient rate of production. Much of the new investment going into these developments and improvements has been made during the past 15 years. It is notable, therefore, that in total the processing firms in that area do not see any substantial slackening of this rate of development and investment in the future. Their estimates of prospective investment were provided on two separate bases. An historical record of investments during the past 15 years was supplied and, as a further check, each firm estimated its prospective future investment. Investment plans for the future were in very close agreement with the rates reported during the past decade and a half. New investment in fixed assets in B.C. fish processing was expected to aggregate about $36 million over the next 25 years. Replacement of fixed assets was estimated to require almost $16 million during the same period. Working capital was estimated to increase by $19 million but, based on recent increases, might rise by as much as $29 million in that period.[10]

In total, British Columbia's processing firms estimated a demand for over $71 million in new and replacement capital over the next 25 years, while their past investment record would place the estimate at close to $90 million. In short, the B.C. processors foresee almost a doubling of their current capital in the form of new fixed assets and additional working capital. This indicates an annual level of new capital investment of about $2.2 million. In addition, replacement investment may be expected to add a further $15 million, or $0.6 million a year, to investment demand. In the view of the industrial leaders concerned, no difficulties are foreseen in obtaining this supply of capital.[11]

The outlook for capital development in the other provinces differs markedly from that in British Columbia. In the Atlantic Provinces, with much less centralization of processing, greater diversity of products, and a much larger proportion of the processing carried out in relatively small-scale plants, the secondary industry is likely to have greater difficulties in reaching an effective level of capital improvement and development. At

the same time, a substantial part of the processing industry in that region is already operating in fairly large scale, mechanized plants equipped with modern machinery. This applies particularly to plants processing frozen fillets and to some of those equipped for drying salted fish mechanically. There were 35 such plants that had sales of over $500,000 in 1954 (Table VI). On the other hand, most of the plants are small: over half of them had sales under $50,000 in that same year. Often these small plants are poorly mechanized and inefficient. It is with such plants, of course, that the greatest opportunity for improving the effectiveness of processing commonly lies.

In the Maritimes, for example, processing industry representatives indicate[12] that there is as much scope for improving efficiency in processing as in primary fishing operations. This development may call for the scrapping of some plants and the transfer of processing operations to plants large enough to warrant installation of the capital equipment that will permit productivity and quality to be improved. In the main, processors on the Atlantic Coast have probably been conservative in adopting these new machines and new techniques for processing. Though Atlantic Coast processing may never reach the level of productivity that the Pacific industry can attain, many opportunities exist for greatly improving the productivity of processing in this region.

To take advantage of these opportunities and those that may develop during the next 25 years, a much higher rate of investment than is projected above for British Columbia would be necessary. The annual rate of new investment in the Pacific area was estimated at about 3.3% of existing capital investment in 1956. This would suggest a rate in the Atlantic Provinces of probably 5% or more for particular areas. In some east coast areas, this 5% rate has been attained for short periods but it seems unlikely that it can be maintained for the whole region over the 25-year period. The rate, however, will depend upon the willingness of processing firms in that region to adapt methods and equipment to changing requirements. There are indications that a younger generation in management, just now beginning to come into responsibility, may make the necessary break with tradition that will be needed if the industry is to attain a satisfactory degree of efficiency. There is also some evidence of a beginning of the concentration and integration that may be also necessary to this end.[13] Effective financing of capital expansion may depend in large degree upon such concentration and integration. This is because only large-scale operations may warrant the organization and the quality of management needed to attract new capital for investment in processing.

Supply of Capital and Credit

The above estimates indicate that over the next 25 years a substantial flow of new capital will be required to meet the demand in both the

primary and secondary industries. There are, however, two main problems related to this flow. One is to ensure that the supply is reasonably adequate relative to the need. The other is concerned with the measures needed to encourage the use of more capital in those areas that are falling behind the rest of the economy in economic development.

In the primary industry, as in the secondary, these problems arise chiefly in particular regions. In the Pacific area little difficulty has been experienced, and little may be expected, in obtaining a supply of capital needed to maintain and expand a relatively efficient and modern fishing fleet. It may be expected that, in the future as in the past, qualified fishermen will be able to obtain capital on the strength of their own commercial credit rating. Processing companies may also continue to provide some of the financing for new vessels, gear and the like. The small-boat insurance programme established by the government of Canada in 1953 has enabled these firms to provide credit with much less risk than formerly. In the main, it may be expected also that the secondary industry in British Columbia will have little difficulty in financing its own needs for new and replacement capital for improving or expanding its processing facilities.

The most difficult problems in capital development are likely to be encountered in the Atlantic area. Here the low productivity of many of the fishermen and the uncertainty of their income led in the past to a great deal of capital rationing in the primary industry. In other words, although the rate of return from extra capital inputs in the fishing enterprise was greater than the interest rate on capital, the fisherman, largely because of the burden of economic uncertainty confronting him, either did not want to borrow the additional capital or could not obtain it if he tried. This means that capital development in the primary industry in the Atlantic region is likely to involve two major phases. On the one hand, it will be concerned with the provision of a supply of loanable funds for this development. On the other, it may continue to require a fairly vigorous programme to assist and encourage fishermen to use such funds as a means of increasing their productivity.

Because of the extent of these particular conditions in the Atlantic Provinces, it has been necessary for both federal and provincial governments to provide financing to enable the primary industry to break away from its small-boat, low-productivity environment. Some progress has been made already but much remains to be done during the next 25 years. There is now a well-established organization to guide and assist this capital improvement. Loan funds for vessel construction and improvements have been established in all five Atlantic Provinces. The Fisheries Improvement Loans Act, set up by the federal government in 1955, provides for loans up to $4,000 for purchase or repair of fishing vessels or equipment. In some cases a federal subsidy is provided to assist individual fishermen in the construc-

tion of an efficient fishing vessel. Risks of capital loss have been reduced by the small-boat insurance plan noted above.[14]

As a result of the stimulus provided by this programme, there has been a substantial improvement in capital in the primary industry on the Atlantic Coast. With the groundwork thus laid, the further capital development needed may proceed at a more rapid rate. That will, of course, require a corresponding increase in the supply of loanable funds and it seems likely that the provinces may be increasingly called upon by fishermen to supply this credit. This growing demand for credit may become difficult for the provinces to meet.

At the same time, there is evidence that provincial governments are becoming more and more concerned with the difficulties being encountered by processing firms in financing development in the Atlantic Provinces.[15] Newfoundland and Quebec have gone farthest in meeting the demand for special credit facilities. In Prince Edward Island and New Brunswick considerable assistance and direction have also been supplied. In Nova Scotia, where the industry is long established, proportionately less direct assistance has been given. It seems likely that contributions by government to the financing of processing development will continue and expand in the Atlantic Provinces—in the expectation that these injections of capital will eventually enable all branches of the industry in this area to reach a level of productivity that will support, within the next decade or two, the financing of new investment automatically from funds supplied by the firms themselves.

Employment and Earnings

In the fisheries, as in most industries, the level of employment is a function not only of earnings but of the other social and physical conditions prevailing in the industry. In the fishing industry, in the Atlantic Provinces particularly, and to a lesser extent in British Columbia and the inland area, employment is commonly subject to low earnings. In addition, in all regions, employment in fisheries is ordinarily marked by much seasonality, isolation, primitive equipment, uncertainty of catch and income, physical hardship and risk and limited social and other cultural opportunities. As a result, there is still much poverty and privation and these are ordinarily combined with concealed unemployment; productivity and incomes are low; education is limited; and opportunities for higher-paid employment are, commonly, either unavailable or unobtainable owing to lack of training or experience.

Some of these handicaps are a consequence of physical conditions in the fishing areas while others are largely man made. All of them can be substantially modified by man's activities, however. For example, the shortness of season (a particularly severe handicap where boats are small

and not very seaworthy) is governed to a large extent by the severity of weather conditions throughout the year.[16] But the effect of severe weather conditions is reduced very greatly by using larger vessels equipped with the improved gear that is now available including communication, radar and fish-finding equipment. These larger vessels not only permit fishermen to fish over a longer period, they make it possible to fish on more days during that longer period and to extend fishing operations to other areas and other species that could not be fished with the smaller boats. The measure of these advantages is provided in the results of a sample survey of gill-netters and trollers in British Columbia made in 1953 and 1954.[17] The survey indicates that, on the average, fishermen's net cash receipts increase as the number of days of fishing and the size of boat (measured by length) increase, as shown below:

	Gill-Net Fishermen			Troll Fishermen		
Net cash receipts	No.of fishermen	Length of boat (ft.)	Days afloat	No. of fishermen	Length of boat (ft.)	Days afloat
Less than $1,000	20	28	61	17	30	81
$1,000 - 1,999. .	20	30	79	15	35	85
$2,000 - 2,999. .	9	31	95	9	36	112
$3,000 - 3,999. .	9	33	104	6	39	106
$4,000 and over .	6	34	106	4	34	104

Similar studies in the Atlantic Provinces indicate an even greater relative increase in the number of days of fishing as the size of the vessel (based on length, tonnage and horsepower) increases, as indicated in the following summary of the data for 1955:[18]

Type and Size-Class of boat[19]	No. of boats in sample	Average over-all length (ft.)	Average per Boat Gross tonnage	H.P. engine	Days at sea
TRAPBOAT/LONG-LINERS					
31 to 37 ft.	8	33.7	9	47	66
LONG-LINERS					
35 to 50 ft.	8	44.9	21	99	56
50 to 60 ft.	32	55.5	39	131	105
DRAGGERS					
46 to 50 ft.	11	49.1	26	118	91
54 to 60 ft.	53	58.6	45	148	118
60 to 65 ft.	4	64.3	55	194	154

A short fishing season may not have a very serious effect on employment and earnings in areas where some alternative employment is readily available to the fishermen. On the other hand, in areas where off-season jobs are not available, a limited season may restrict earnings to a very low level. Many settled fishing communities are seriously isolated in this respect, particularly in the Atlantic Provinces. Their isolation stems largely from lack of communication and transportation facilities, though

these have been improved greatly in many settlements since World War II. In most cases, the fishermen so situated remain isolated because their incomes are so low they are unable to finance the cost of moving elsewhere. Lack of funds or facilities for education often limit opportunities for outside employment. As a result, those best equipped with finances, education and capabilities tend to move to better opportunities, leaving those remaining more isolated than ever in some respects.

Two other characteristics of the fishing industry have had a significant effect on levels of employment and earnings. The first is the primitive nature of much of the fishing equipment used in a number of areas. Many boats are small—too small for any but one-man operation. Gear in these boats is commonly operated manually and few, if any, of them are equipped with direction-finding or fish-finding equipment. Under these conditions, the hardship and the risk of loss of life or equipment is great, while the possibilities of a large catch are correspondingly small. The handicaps arising from the lack of capital equipment can be overcome, but this usually requires not only a source of credit for the improvement of boats and gear but also an extension programme in the techniques of handling larger boats, power-operated gear and electronic devices. A good deal of progress, indeed, is being made in both of these directions in the Atlantic Provinces, where the problem is perhaps most acute.

Another characteristic of employment in the fisheries relates to the uncertainties of catch and hence of income. That these uncertainties may be very important is implied in the prevalence of the practice of having the crew assume part of the risk of uncertain catch by paying them with a share of the catch rather than guaranteeing a definite wage. These uncertainties of catch are often closely related to the vagaries of the weather but other important factors may also cause great variation in the size of catch. For example, there is commonly much loss of time and effort at sea because fish (such as herring and certain species of groundfish) cannot readily be found in suitable numbers for a satisfactory catch. Fishermen cannot depend always upon finding fish, even in their accustomed locations. For centuries, dependence for fish finding rested to a considerable extent on certain fishermen, i.e. fishing skippers,[20] who were presumed to have a so-called sixth sense for finding fish. Whether this was anything more than the result of many years' experience combined with good judgment cannot be certain, but the enthusiasm with which fishermen have recently been making use of electronic fish-finding equipment and of the results of oceanographic and biological studies of fish stocks indicates that finding fish has not been easy for individual fishermen in the past. In this respect larger vessels may also provide substantial advantages to fishermen, because the cost of electronic fish-finding equipment is often so high that it is only warranted on a vessel that has a very large productive capacity.

Uncertainty in the prices fishermen expect to obtain for their catch may in some cases be a serious problem but, in most of the important fisheries, prices to the fishermen are established at the beginning of each season and ordinarily fluctuate very little. Though prices to fishermen may be low in some cases and thus a factor in causing low earnings, they are nevertheless for the most part free from sharp fluctuations and normally do not contribute seriously to the uncertainty of fishermen's income.

With the productivity of fishermen sharply limited in certain areas by the above-noted characteristics of shortness of season, isolation, prevalence of primitive equipment and uncertainty of catch, it may be expected that incomes in these areas will be relatively low. They are usually particularly low in those areas where outdated equipment is still in use and where opportunities for supplementary earnings are few. Such low-income conditions are fairly common in certain districts on the Atlantic Coast while in other districts earnings are generally satisfactory. Thus on the one extreme may be found the inshore fishermen of Newfoundland, where in 1951 the average income of a "skipper-man"[21] (which at that time was probably substantially above the average income of other inshore fishermen) and his family was only $1,300 from all sources.[22] The incomes of fishermen in some of the more isolated districts of the Maritime Provinces and Quebec are likely to be similarly low. On the other hand, in British Columbia, where an above average proportion of the fishermen have both modern equipment and opportunities for supplementary earnings, the average income of salmon fishermen from all sources in 1954 was $3,056[23] almost exactly the same as the average annual earnings ($3,057) of all paid workers in the Canadian labour force in that year.[24]

It may be appropriate at this point to emphasize that an increasing disparity in incomes in Canada may be brought about through economic development. Thus, as already suggested, while most of the rest of the economy as well as the major part of the fishing industry may continue to grow and prosper during the next few decades, this development is unlikely to reach into many of the more isolated fishing settlements. As a result, certain communities of fishermen are likely to be left even farther behind economically than they are at present. It may be anticipated that these scattered pockets of poverty may pose some of the most difficult problems of employment and earnings in the fisheries during the next quarter century. This is because, as a result of their isolation, low incomes, and lack of educational opportunities, the people in these settlements may have increasing difficulty in obtaining supplementary or alternative employment.

Much progress has been made in helping these communities of fishermen and their families to improve both their productivity and incomes, particularly during the past decade. In spite of these efforts, however,

current earnings in many parts of the fishery are still very low and there are fairly clear indications that they will remain relatively low unless the level of employment in fisheries is substantially reduced. The considerations supporting this conclusion are worth noting. In the first place, the projections of future fish catches examined above indicate a relatively modest expansion of landings. On the other hand, there is much underemployment in the fisheries at present. Accentuating this has been the current expansion in the use of improved types of boats, gear and fishing techniques and this expansion of capital may be expected to continue during the next 25 years. The substitution of capital for labour should enable the marketable catch to be taken by a decreasing number of fishermen. Over-all it seems likely that the demand for labour in the primary industry may be significantly reduced during the next few decades. If, with the decrease in demand for labour, the supply of labour is maintained at present levels, there is likely to be much greater underemployment than there is now and incomes are likely to be correspondingly low.

The prospect for reduced labour requirements reflects the current situation in which substantial segments of the fishing industry are characterized by low incomes, underemployment and a lack of supplementary job opportunities. In these circumstances, it might be expected that the more mobile members would move to more remunerative occupations when suitable opportunities offer. This has, in fact, been the case. The movement out of the fishery has been quite marked since 1946. With economic activity in other industries in a buoyant state since World War II, opportunities for employment outside the fisheries have been excellent. Many fishermen took advantage of these opportunities and the result has been a very large reduction in total numbers. The sharpest decline in numbers has been in those provinces where incomes and productivity were lowest and fishermen's families most isolated. This movement out of the fishery was particularly conspicuous in Newfoundland where, from 1947 to 1954, an estimated 38% of the fishermen appear to have taken up other employment (Table VII and Fig. 39).

Newfoundland was a special case, however, marked by a rapid growth of alternative employment opportunities—very few of which existed prior to the war. Such a rapid decline could hardly be expected to continue more than a few years. By 1953, the rate of decline had already materially lessened (Table VII). Because of the considerable fluctuations during the two decades examined, no clear long-term trend can be observed. In general, however, a continued decline is suggested but at a less rapid rate than that of the past eight years.

In the case of the other provinces, changes in numbers have been more moderate but, aside from the war years, a fairly clear downward trend seems evident. On the basis of the period before 1941 (1937-40)

and after 1946 (1947-54), the trend is fairly steadily downward at an average rate of 1,000 fishermen every two and a half years. If this average rate of decline continues — and it appears to be fairly reasonable and moderate—the number of fishermen in Canada, excluding Newfoundland, will be about 16% lower in 1980 than in 1954[25] (Fig. 39).

There are, of course, a number of influences which will tend to work against this downward trend. Still important, in this respect, is the shortage of transportation and communication services in many fishing settlements, which results in isolation and hence tends to reduce mobility. Low incomes, inadequate educational facilities and lack of information on suitable alternative employment all contribute to restricting the mobility of labour in the fisheries. The retarding effect of these influences may increase as the movement out of the industry continues. This is because the most mobile fishermen move first, leaving an increasingly less mobile group behind them. At the same time, fishermen, whether living in isolated poverty or not, are becoming more familiar with opportunities and advantages that may be available elsewhere. They and their families are realizing that they may have the opportunity to enjoy social conditions and amenities similar to those enjoyed by workers in other places. They are beginning to realize also that to do so they must either increase their incomes by improving their productivity or move to larger settlements where such social facilities can be obtained at reasonable cost. In many, perhaps most, cases, the improvement in productivity may hinge upon their moving to larger settlements where a larger and more dependable market is available for their catch.

In the fish processing industry as in the primary industry, the past two decades have been marked by significant changes in levels of employment. These were in part related to changes in the structural development of the industry. For example, until fairly recent years in certain fishing areas a substantial part of the canning and curing of fish was carried out as a small, part-time, family enterprise, often in conjunction with the family fishing operations. In Newfoundland a large part of the production is still processed under this system.[26] Since before the beginning of the present century, however, this cottage-handicraft type of processing has been giving way to larger scale, mechanized factory operations. The old system has been particularly persistent in the Atlantic Provinces, especially in those outlying fishing settlements which are isolated by distance or other obstacles from both fresh fish markets and large processing plants.

In British Columbia, on the other hand, large-scale processing began to develop earlier and has in recent years proceeded more rapidly. This recent development in British Columbia has been marked by a substantial concentration of processing facilities — a concentration in terms of both

geographic location and size of plant. The numbers of salmon canneries, for example, fell from a peak of 94 in 1917 to 20 in the 1954-55 season. This kind of concentration has been made possible by the use of refrigeration and fast packing boats to gather the raw material from widely dispersed areas and bring it to points of concentration. The development of high-speed processing machinery with its possibilities for cost reduction has also been an important element.

Largely as a result of this concentration, employment in fish processing in British Columbia has declined fairly steadily since 1936, with the exception of the war years when a large expansion of canning for overseas shipment took place (Table VIII). In the Maritime Provinces and Quebec on the other hand, with the persistence in many areas of small-scale, manual processing, the reduction in employment through concentration has been less rapid. Aside from the fluctuations attributable to wartime influences, there was very little change in the numbers employed in the Maritimes-Quebec region from 1917 to 1954, except for an expansion about the end of the last war, partly attributable to the growth of fresh fish filleting and of factory drying of salt fish. Most of this recent development has been based on larger scale processing operations and these have gradually resulted in some increased concentration. In total, the number employed in processing in this region fell by about 17% between 1946 and 1952.[27] In Newfoundland, comparable records are available for a much shorter period but the rapid decline in domestic or handicraft processing there has been partly offset by an expansion of larger scale filleting operations since World War II. The net result has been a decline in processing employment in that province also, though the extent of the decline is not yet clearly established.

As for the future labour supply for fish processing, the problems are likely to vary considerably from region to region. In the case of most of the industry in British Columbia, since it is concentrated in the highly industrialized Vancouver area, it will be forced to compete in the open market for both skilled and unskilled labour. Its labour supply should be ample, provided it can meet the labour costs found in competing industries.

On the other extreme are the scattered processing operations carried on in relatively isolated areas. In many such areas numbers of underemployed fishermen are to be found and there is unlikely to be any shortage except for specially skilled labour. The wives and daughters of fishermen may also provide a substantial part of the labour force required. Where the fish are caught by transient fishermen and delivered to a temporary processing plant nearby, it may be found increasingly difficult to obtain a satisfactory supply of plant labour for operations close to the fishing grounds. This is likely to encourage further concentration of processing at central locations.

In regions where conditions are intermediate between those just outlined, a number of influences are likely to operate to reduce the demand for labour. In the Maritimes and Quebec, for example, the transfer of processing from small-scale handicraft to large-scale factory operations is likely to continue in the canning, curing and smoking of fish. In Newfoundland, a similar movement is already well underway in the salting and drying branch of the industry. In both regions, the labour force is likely to be substantially reduced by these developments.

In these regions also, there is a good possibility of further concentration of processing as improved methods of preserving raw fish are utilized to a greater extent. In the past, the high cost of transporting fish has been a serious limitation on concentration. But the transportation costs were high because of heavy losses resulting from the perishability of the product, not because of the costs of operating the transport. There are now clear indications that deterioration in transit can be effectively postponed, at least for a sufficient time to enable the raw material to be brought to central ports in the larger and faster transport facilities available today. As a result, it may be possible for the processing industry to concentrate operations further and thus increase its productivity in processing while reducing its labour requirements.[28] Quite rapid progress has been made in this direction in recent years in the Maritime Provinces and Quebec. In the four years from 1951 to 1954, the number of processing plants in that region fell by more than 10%, from 532 to 475. In the same period, the number of processing plants with a value of production of $50,000 or over increased by almost 7% in the region as a whole, although the number in Quebec decreased slightly.


ARCTIC OCEAN
Bering Strait
BEAUFORT SEA
ALASKA
GREENLAND
ICELAND
DAVIS STRAIT
BAFFIN ISLAND
GULF OF ALASKA
YUKON
NORTHWEST TERRITORIES
Great Bear Lake
Great Slave Lake
Athabaska
QUEEN CHARLOTTE IS.
PRINCE RUPERT
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
HUDSON BAY
CHURCHILL
Reindeer Lake
JAMES BAY
ONTARIO
QUEBEC
COAST OF LABRADOR
VANCOUVER ISLAND
VANCOUVER
Lake Winnipeg
Lake Manitoba
WINNIPEG
Lake of the Woods
L. Nipigon
L. SUPERIOR
SAULT STE MARIE
Georgian Bay
L. HURON
L. ONT
L. ERIE
LAKE MICHIGAN
CHICAGO
NEW YORK
OTTAWA
MONTREAL
Lawrence R.
GULF OF ST LAWRENCE
Laurentian Channel
St Pierre Bank
Grand Bank
NFLD.
ST JOHNS
P.E.I.
N.S.
HALIFAX
LUNENBURG
Sable Is Bank
Banquereau
Georges Bank
1
2
3
4
5
PACIFIC OCEAN
ATLANTIC OCEAN
UNITED STATES
120°
110°
100°
90°
80°
70°
60°
CANADA
SHOWING LOCATION OF PRINCIPAL SEA AND INLAND FISHERIES
—LEGEND—
COASTLINE AND INTERNATIONAL BOUNDARY
100 FATHOM CONTOUR
EDGE OF CONTINENTAL SHELF
SCALE - 100 0 100 200 300 400 NAUT. CAL. MILES
DRAWN BY H.P.MAY

LIST OF PRINCIPAL SPECIES IN CANADIAN COASTAL AND INLAND WATERS

Common Name	Classification
1. Marine and Freshwater Fishes	
a) Atlantic	
Alewife, Blueback	*Pomolobus aestivalis*[1]
Alewife, Common	*Pomolobus pseudoharengus*[1]
Angler	*Lophius piscatorius*
Argentine	*Argentina silus*
Bass, Striped	*Roccus saxatilis*[1]
Billfish	*Scomberesox saurus*
Blenny (see Rockeel)	
Bream (see Redfish)	
Broadbill (see Swordfish)	
Butterfish	*Poronotus triacanthus*
Capelin	*Mallotus villosus*[1]
Catfish (see Wolffish)	
Charr, Arctic	*Salvelinus alpinus*[1]
Chimaera	*Hydrolagus affinis*
Cod	*Gadus callarias*[1]
Cunner	*Tautogolabrus adspersus*
Cusk	*Brosme brosme*[1]
Dab, Rough (see Plaice)	
Dogfish, Black	*Centroscyllium fabricii*
Dogfish, Common or Spiny	*Squalus acanthias*
Dollarfish (see Butterfish)	
Eel, Common	*Anguilla rostrata*[1]
Eel, Longnose	*Synaphobranchus pinnatus*
Eelpout (see Pout)	
Flounder, Sand	*Lophopsetta maculata*
Flounder, Smooth	*Liopsetta putnami*
Flounder, Winter	*Pseudopleuronectes americanus*[1]
Flounder, Witch	*Glyptocephalus cynoglossus*[1]
Flounder, Yellowtail or Rusty	*Limanda ferruginea*[1]
Gaspereau (see Alewife)	
Ghostfish	*Cryptacanthodes maculatus*
Goosefish (see Angler)	
Grenadier (see Rattail)	
Haddock	*Melanogrammus aeglefinus*[1]
Hake, Blue	*Antimora rostrata*
Hake, Common or Red	*Urophycis chuss*[1]
Hake, Longfin	*Urophycis chesteri*
Hake, Silver	*Merluccius bilinearis*

Common Name	Classification
a) Atlantic—Continued	
Hake, Squirrel (see Common Hake)	
Hake, White	*Urophycis tenuis*[1]
Halibut, Common	*Hippoglossus hippoglossus*[1]
Halibut, Greenland	*Reinhardtius hippoglossoides*[1]
Herring	*Clupea harengus*[1]
John-dory	*Zenopsis ocellata*
Kyak (see Alewife)	
Lamprey	*Petromyzon marinus*
Launce, Sand	*Ammodytes americanus*
Ling (see Common and White Hake)	
Lumpfish	*Cyclopterus lumpus*
Mackerel, Common	*Scomber scombrus*[1]
Mackerel, Chub	*Pneumataphorus grex*
Monkfish (see Angler)	
Minnow (see Mummichog)	
Mummichog	*Fundulus heteroclitus*
Perch, Blue (see Cunner)	
Perch, Ocean (see Redfish)	
Perch, White	*Morone americana*[1]
Plaice	*Hippoglossoides platessoides*[1]
Pollock	*Pollachius virens*[1]
Porbeagle (see Mackerel Shark)	
Pout, Artic	*Lycodes reticulatus*
Pout, Common or Ocean	*Macrozoarces americanus*
Rattail, Common	*Macrourus bairdi*
Rattail, Smoothspine or Roughhead	*Macrourus berglax*
Ray, Electric	*Torpedo nobiliana*
Redfish	*Sebastes marinus*[1]
Rockeel	*Pholis gunellus*
Rockling	*Enchelyopus cimbrius*
Rosefish (see Redfish)	
Rudderfish	*Seriola zonata*
Salmon	*Salmo salar*[1]
Sardine (see Herring)	
Sculpin, Common or Shorthorn	*Myoxocephalus scorpius*
Sculpin, Longhorn	*Myoxocephalus octodecemspinosus*
Sea-raven	*Hemitripterus americanus*
Shad	*Alosa sapidissima*[1]
Shark, Basking or Bone	*Cetorhinus maximus*
Shark, Blue	*Prionace glauca*
Shark, Greenland or Sleeper	*Somniosus microcephalus*
Shark, Mackerel	*Lamna nasus*
Shark, White or Maneater	*Carcharodon carcharias*

Common Name	Classification
a) Atlantic—Continued	
Shark, Thresher or Fox (see also Dogfish)	*Alopias vulpinus*
Silverside	*Menidia menidia*[1]
Skate, Barndoor	*Raja laevis*[1]
Skate, Big or Eyed	*Raja ocellata*[1]
Skate, Common or Little	*Raja erinacea*[1]
Skate, Prickly	*Raja senta*
Skate, Spinytail	*Raja spinicauda*
Skate, Starry	*Raja scabrata*[1]
Skate, Thorny	*Raja radiata*
Skipper (see Billfish)	
Smelt	*Osmerus mordax*[1]
Sole, Grey (see Witch Flounder)	
Sole, Lemon (see Winter Flounder)	
Stickleback	*Gasterosteus aculeatus* *Pungitius pungitius*
Sturgeon, Common	*Acipenser sturio*[1]
Swordfish	*Xiphias gladius*[1]
Tomcod	*Microgadus tomcod*[1]
Trout, Sea (see Charr)	
Tuna, Bluefin	*Thunnus thynnus*[1]
Turbot (see Greenland Halibut)	
Whiting (see Silver Hake)	
Windowpane (see Sand Flounder)	
Wolffish, Common or Striped	*Anarhichas lupus*[1]
Wolffish, Spotted	*Anarhichas minor*
Wrymouth (see Ghostfish)	
b) Pacific	
Anchovy	*Engraulis mordax*[1]
Barracuda	*Sphyraena argentea*
Bass, Black (see Priestfish and Black Rockfish)	
Bass, White	*Cynoscion nobilis*
Blenny, Belted	*Phytichthys chirus*
Blenny, Black	*Epigeichthys altopurpureus*
Blenny, Bracketed	*Pholis laetus*
Blenny, Crested	*Anoplarchus purpurescens*
Blenny, Fucus	*Xererpes fucorum*
Blenny, Penpoint	*Apodichthys flavidus*
Blenny, Rock	*Xiphister mucosus*
Blenny, Saddled	*Pholis ornatus*
Bocaccio	*Sebastodes paucispinis*[1]
Bonito	*Sarda lineolata*

Common Name	Classification
b) Pacific—Continued	
Bream (see Pomfret)	
Brill	*Eopsetta jordani*[1]
Bullhead (see Sculpin)	
Cabezon	*Leptocottus armatus*
Candlefish (see Eulachon)	
Capelin	*Mallotus catervarius*
Cod, Black (see Sablefish)	
Cod, Cultus (see Lingcod)	
Cod, Grey	*Gadus macrocephalus*[1]
Cod, Rock (see Rockfish)	
Dab, Sand (see Dab)	
Dab, Mottled	*Citharichthys sordidus*[1]
Dab, Speckled	*Citharichthys stigmaeus*
Dogfish	*Squalus suckleyi*
Eel-blenny	*Lumpenus anguillaris*
Eel-pout (see Pout)	
Eulachon	*Thaleichthys pacificus*[1]
Flounder, Longjaw (see Turbot)	
Flounder, Starry	*Platichthys stellatus*[1]
Greenling, Fringed	*Lebius superciliosus*
Greenling, Kelp	*Chiropsis decagrammus*
Greenling, Whitespotted	*Hexagrammus stelleri*
Greyfish (see Dogfish)	
Gurnard (see Spinycheek Rockfish)	
Hake	*Merluccius productus*
Halibut	*Hippoglossus stenolepis*[1]
Herring	*Clupea pallasii*[1]
Irish-lord, Red	*Hemilepidotus hemilepidotus*
Lamprey	*Entosphenus tridentatus*
Launce, Sand	*Ammodytes personatus*
Lingcod	*Ophiodon elongatus*[1]
Mackerel, Pacific	*Pneumatophorus diego*
Megrim (see Mottled Dab)	
Moonfish (see Opah)	
Opah	*Lampris regius*
Perch, Blue	*Taeniotoca lateralis*
Perch, Dusky	*Damalichthys vacca*
Perch, Ocean (see Longjaw Rockfish)	
Pilchard	*Sardinops caerulea*
Pollack (see Whiting)	
Pomfret	*Brama raii*
Pout, Blackbelly	*Lycodopsis pacificus*
Pout, Blackfin	*Furcimanus diapterus*

Common Name	Classification
b) Pacific—Continued	
Pout, Shortfin	*Lycodes brevipes*
Priestfish	*Sebastodes mystinus*
Prowfish	*Zaprora silenus*
Ragfish, Brown	*Acrotus willoughbyi*
Ratfish	*Hydrolagus colliei*
Ray, Electric	*Tetranarce californica*
Ray, Sting	*Dasyatis dipterurus*
Rockfish, Banded	*Sebastodes nigrocinctus*
Rockfish, Black	*Sebastodes melanops*[1]
Rockfish, Blackthroat	*Sebastodes introniger*[1]
Rockfish, Copper	*Sebastodes caurinus*[1]
Rockfish, Greenstriped	*Sebastodes elongatus*
Rockfish, Longjaw	*Sebastodes alutus*[1]
Rockfish, Orange	*Sebastodes pinniger*[1]
Rockfish, Orangespotted	*Sebastodes maliger*[1]
Rockfish, Spinycheek	*Sebastolobus alascanus*[1]
Rockfish, Yellowstriped	*Sebastodes nebulosus*
Rockfish, Yellowtail	*Sebastodes flavidus*[1]
(see also Bocacio, Priestfish and Red Snapper)	
Ronquil	*Ronquilis jordani*
Sablefish	*Anoplopoma fimbria*[1]
Salmon, Blueback (see Coho Salmon)	
Salmon, Chum or Dog	*Oncorhynchus keta*[1]
Salmon, Coho or Silver	*Oncorhynchus kisutch*[1]
Salmon, Pink or Humpback	*Oncorhynchus gorbuscha*[1]
Salmon, Sockeye or Red	*Oncorhynchus nerka*[1]
Salmon, Spring or Chinook	*Oncorhynchus tshawytscha*[1]
Salmon, King or Tyee (see Spring Salmon)	
Sardine (see Pilchard)	
Saury	*Cololabis saira*
Scad	*Decapterus polyaspis*
Sculpin, Buffalo	*Enophrys bison*
Sculpin, Giant	*Erilepis zonifer*
Sculpin, Great	*Myoxocephalus polyacanthocephalus*
Sculpin, Silverspot	*Blepsias cirrhosus*
(see also Cabezon and Irish-lord)	
Shad, Atlantic	*Alosa sapidissima*
Shark, Basking	*Cetorhinus maximus*
Shark, Blue	*Prionace glauca*
Shark, Mackerel	*Isurus nasus*
Shark, Mud	*Hexanchus griseus*
Shark, Soupfin	*Galeorhinus galeus*
Shark, Spotted-cow	*Notorhynchus cepedianus*

Common Name	Classification
b) Pacific—Continued	
Shiner, Yellow	*Cymatogaster aggregatus*
Skate, Big	*Raja binoculata*[1]
Skate, Longnose	*Raja rhina*[1]
Skate, Prickly	*Raja stellulata*
Skilfish, Giant	*Erilepsis zonifer*
Skipjack	*Katsuwonis pelamis*
Skipper (see Saury)	
Smelt, Black	*Bathylagus milleri*
Smelt, Longfin	*Spirinchus dilatus*
Smelt, Silver or Surf	*Hypomesus pretiosus*[1]
Snapper, Red	*Sebastodes ruberrimus*[1]
Sole, Arrowtooth (see Turbot)	
Sole, Butter	*Isopsetta isolepis*[1]
Sole, C–O	*Pleuronichthys coenosus*
Sole, Dover	*Microstomus pacificus*[1]
Sole, Flathead	*Hippoglossoides elassodon*
Sole, Lemon	*Parophrys vetulus*[1]
Sole, Petrale (see Brill)	
Sole, Rex	*Glyptocephalus zachirus*[1]
Sole, Rock	*Lepidopsetta bilineata*[1]
Sole, Sand	*Psettichthys melanostictus*
Sole, Slender	*Lyopsetta exilis*
Sole, Yellowfin	*Limanda aspera*
Stickleback	*Gasterosteus aculeatus*
Sturgeon, Green	*Acipenser medirostris*
Sturgeon, White	*Acipenser transmontanus*[1]
Surffish (see Perch and Shiner)	
Tomcod	*Microgadus proximus*
Trout, Steelhead	*Salmo gairdnerii*[1]
Tuna, Albacore or Longfin	*Thunnus alalunga*
Turbot	*Atheresthes stomias*[1]
Whiting	*Theragra chalcogramma*[1]
Wolfeel	*Anarrhichthys ocellatus*
Wrymouth	*Delolepis giganteus*
c) Inland	
Alewife	*Pomolobus pseudoharengus*
Bass, Black (see Largemouth and Smallmouth Bass)	
Bass, Largemouth	*Micropterus salmoides*
Bass, Smallmouth	*Micropterus dolomieu*
Bass, Calico (see Black Crappie)	
Bass, Green (see Largemouth Bass)	
Bass, Rock or Redeye	*Ambloplites rupestris*[1]

Common Name	Classification
c) Inland—Continued	
Bass, White	*Lepibema chrysops*[1]
Billfish (see Gar)	
Bloater	*Leucichthys hoyi*
Blueback (see Lake Herring)	
Bluegill	*Lepomis macrochirus*
Bowfin	*Amia calva*
Bream (see Bluegill and Golden Shiner)	
Buffalofish	*Ictiobus bubalus*[1]
Bullhead (see Brown and Yellow Catfish)	
Burbot	*Lota lota maculosa*[1]
Carp	*Cyprinus carpio*[1]
Carpsucker	*Carpiodes cyprinus*[1]
Catfish, Channel	*Ictalurus punctatus*[1]
Catfish, Common or Brown	*Ameiurus nebulosus*[1]
Catfish, Yellow	*Ameiurus natalis*
Charr, Dolly-Varden	*Salvelinus malma*
Charr, Red or Marston's	*Salvelinus alpinus*
Charr, Speckled (see also Grey Trout)	*Salvelinus fontinalis*
Chub (see Cisco)	
Chub, Common or Creek	*Semotilus atromaculatus*
Chub, Flathead	*Platygobio gracilis*
Chub, Lake	*Couesius plumbeus*[1]
Chub, Silver (see Fallfish and Troutperch)	
Chubsucker	*Erimyzon sucetta*
Cisco, Blackback	*Leucichthys nipigon*[1]
Cisco, Blackfin	*Leucichthys nigripinnis*[1]
Cisco, Deepwater	*Leucichthys johannae*[1]
Cisco, Lightback or Shortjaw	*Leucichthys zenithicus*[1]
Cisco, Longjaw	*Leucichthys alpenae*[1]
Cisco, Common or Shallowwater (see Lake Herring)	
Cisco, Shortnose (see also Bloater, Kiyi and Tullibee)	*Leucichthys reighardi*[1]
Connie (see Inconnu)	
Crappie, Black	*Pomoxis nigromaculatus*[1]
Crappie, White	*Pomoxis annularis*
Dace, Horned (see Creek Chub)	
Dace, Longnose	*Rhinichthys cataractae*
Dace, Pearl	*Margariscus margarita*
Dace, Redbelly	*Chrosomus eos*
Darter (see Log Perch)	
Dogfish (see Bowfin)	
Doré (see Pikeperch)	

Common Name	Classification
c) Inland—Continued	
Drum	*Aplodinotus grunniens*[1]
Fallfish	*Leucosomus corporalis*
Frostfish (see Round Whitefish)	
Gar, Longnose	*Lepisosteus osseus*
Gar, Shortnose	*Lepisosteus platostomus*
Garpike (see Gar)	
Goldeye	*Amphiodon alosoides*[1]
Goldfish	*Carassius auratus*
Grayling	*Thymallus signifer*
Grindle (see Bowfin)	
Herring, Lake	*Leucichthys artedii*[1]
Inconnu	*Stenodus mackenzii*[1]
Jackfish (see Pike)	
Killifish	*Fundulus diaphanus*
Kiyi	*Leucichthys kiyi*
Kokanee	*Oncorhynchus nerka kennerlyi*
Lamper (see Lamprey)	
Lamprey, Brook	*Entosphenus lamotenii* *Ichthyomyzon fossor*
Lamprey, River or Chestnut	*Ichthyomyzon castaneus*
Lamprey, Sea	*Petromyzon marinus*
Lamprey, Silver	*Ichthyomyzon unicuspis*
Ling (see Burbot)	
Loche (see Burbot)	
Lunge (see Maskinonge)	
Maskinonge	*Esox masquinongy*
Menominee (see Round Whitefish)	
Methy (see Burbot)	
Minnow, Bluntnose	*Hyborhynchus notatus*
Minnow, Fathead (see also Chub, Dace and Shiner)	*Pimephales promelas*
Mooneye	*Hiodon tergisus*
Mudminnow	*Umbra limi*
Mullet, Broad (see Carpsucker)	
Mullet, Greater	*Moxostoma valenciennes*[1]
Mullet, Shorhead or Northern	*Moxostoma aureolum*
Mullet, Silver	*Moxostoma anisurum*[1]
Muskie (see Maskinonge)	
Ouananiche (see Salmon)	
Perch, Log	*Percina caprodes*
Perch, Yellow	*Perca flavescens*[1]
Pickerel (see Pike and Pikeperch)	
Pike, Chain or Eastern	*Esox niger*

Common Name	Classification
c) Inland—Continued	
Pike, Common or Northern	*Esox lucius*[1]
Pike, Grass or Mud	*Esox americanus vermiculatus*
Pikeperch, Blue	*Stizostedion vitreum glaucum*[1]
Pikeperch, Yellow (see also Sauger)	*Stizostedion vitreum vitreum*[1]
Pilotfish (see Round Whitefish)	
Pout, Mud (see Catfish)	
Pumpkin-seed	*Eupomotis gibbosus*[1]
Redhorse (see Mullet)	
Roach (see Golden Shiner)	
Salmon, Sebago	*Salmo salar*
Sauger	*Stizostedion canadense*[1]
Sculpin, Deepwater	*Triglopsis thompsonii*
Shad, Gizzard or Hickory	*Dorosoma cepedianum*
Sheepshead (see Drum)	
Shiner, Blacknose	*Notropis heterolepis*
Shiner, Common or Creek	*Notropis cornutus*[1]
Shiner, Emerald (see Lake Shiner)	
Shiner, Golden	*Notemigonus crysoleucas*[1]
Shiner, Lake or River	*Notropis atherinoides*[1]
Shiner, Spottail	*Notropis hudsonius*[1]
Siscowet (see Grey Trout)	
Smelt, Atlantic	*Osmerus mordax*[1]
Squawfish	*Ptychocheilus oregonensis*
Stickleback, Brook	*Eucalia inconstans*
Sturgeon, Lake or Rock	*Acipenser fulvescens*[1]
Sucker, Sweet (see Chubsucker)	
Sucker, Coarsescaled	*Catastomus macrocheilus*
Sucker, Common or White	*Catastomus commersoni*[1]
Sucker, Longnose or Red	*Catastomus catastomus*[1]
Sucker, Quillback (see Carpsucker)	
Sucker, Spotted (see also Buffalofish and Mullet)	*Minytrema melanops*
Sunfish, Blue (see Bluegill)	
Sunfish, Common or Yellow (see Pumpkin-seed)	
Tench	*Tinca tinca*
Togue (see Grey Trout)	
Topminnow (see Killifish)	
Trout, Brook (see Speckled Charr)	
Trout, Brown or Loch-Leven	*Salmo trutta*
Trout, Cut-throat	*Salmo clarkii*
Trout, Grey or Lake	*Cristivomer namaycush*[1]
Trout, Rainbow	*Salmo gairdnerii*

Common Name	Classification
c) Inland—Continued	
Troutperch	*Percopsis omiscomaycus*
Tullibee	*Leucichthys tullibee*[1]
Walleye (see Pikeperch)	
Whitefish, Common	*Coregonus clupeaformis*[1]
Whitefish, Rocky-mountain	*Prosopium williamsoni*
Whitefish, Round	*Prosopium quadrilaterale*[1]
d) Arctic	
Blenny, Snake (see also Shanny)	*Lumpenus lumpretaeformis*
Capelin	*Mallotus villosus*
Charr	*Salvelinus alpinus*
Cod, Greenland	*Gadus ogac*
Cod, Arctic	*Boreogadus saida*
Cod, Atlantic	*Gadus callarias*
Flounder	*Platichthys spp.*
Halibut, Greenland	*Reinhardtius hippoglossoides*
Herring	*Clupea pallasii*
Pout	*Lycodes reticulatus*
Salmon, Atlantic	*Salmo salar*
Sculpin, Arctic	*Cottunculus microps*
Sculpin, Greenland	*Myoxocephalus scorpioides*
Sculpin, Mailed	*Triglops beanii*
Sculpin, Staghorn	*Gymnocanthus tricuspis*
Shanny, Arctic	*Stichaeus punctatus*
Shanny, Common	*Leptoclinus maculatus*
Shanny, Radiated	*Ulvaria subbifurcata*
Shark, Basking	*Cetorhinus maximus*
Shark, Greenland	*Somniosus microcephalus*
Smelt	*Osmerus dentex*
2. Marine Crustaceans and Molluscs	
a) Atlantic	
Clam, Bar or Surf	*Spisula solidissima*[1]
Clam, Cherrystone (see Quahog)	
Clam, Razor	*Ensis directus*[1]
Clam, Softshelled	*Mya arenaria*[1]
Crab, Rock	*Cancer borealis* *Cancer irroratus*
Lobster	*Homarus americanus*[1]
Mussel	*Mytilus edulis*[1]
Oyster	*Crassostrea virginica*[1]
Periwinkle	*Littorina littorea*[1]
Quahog	*Venus mercenaria*[1]

Common Name	Classification
a) Atlantic—Continued	
Scallop	*Placopecten magellanicus*[1]
Shrimp	*Pandalus borealis, etc.*
Squid	*Illex illecebrosus*[1]
b) Pacific	
Abalone	*Haliotis kamchatkana*[1]
Clam, Butter	*Saxidomus giganteus*[1]
Clam, Horse	*Schizothaerus nuttalli*
Clam, Littleneck	*Protothaca staminea*[1]
Clam, Manila	*Venerupis semidecussata*[1]
Clam, Mud	*Mya arenaria*
Clam, Razor	*Siliqua patula*[1]
Cockle	*Cardium corbis*
Crab	*Cancer magister*[1]
Cuttlefish (see Octopus and Squid)	
Geoduck	*Panope generosa*
Mussel	*Mytilus californianus*
	Mytilus edulis
Octopus	*Octopus hongkongensis*[1]
Oyster, Olympic	*Ostrea lurida*
Oyster, Pacific	*Crassostrea gigas*[1]
Prawn	*Pandalus platyceros*[1]
Scallop	*Pecten caurinus*
Shrimp (see also Prawn)	*Pandalus spp.*[1]
Squid	*Loligo opalsecens*
	Gonatus fabricci

3. Marine Mammals

a) Atlantic	
Beluga (see White Whale)	
Seal, Grey	*Halichoerus grypus*
Seal, Harbour or Bay	*Phoca vitulina*
Seal, Harp or Saddleback	*Phoca groenlandica*[1]
Seal, Hooded	*Cystophora cristata*[1]
Whale, Blue or Sulphurbottom	*Sibbaldus musculus*
Whale, Fin	*Balaenoptera physalus*[1]
Whale, Humpback	*Megaptera novaeangliae*
Whale, Minke	*Balaenoptera acutorostrata*[1]
Whale, Pilot or Pothead	*Globicephala malaena*[1]
Whale, Sei	*Balaenoptera borealis*
Whale, Sperm	*Physeter catodon*
Whale, White	*Delphinapterus leucas*[1]
b) Pacific	
Otter, Sea	*Enhydra lutris*

Common Name	Classification
b) Pacific—Continued	
Porpoise, Dall	*Phocoenoides dalli*
Sea-lion	*Eumetopias jubata*
Seal, Fur	*Callorhinus ursinus*[1]
Seal, Harbour	*Phoca vitulina*
Whale, Blue	*Balaenoptera musculus*[1]
Whale, Fin	*Balaenoptera physalus*[1]
Whale, Grey	*Eschrichtius glaucus*
Whale, Humpback	*Megaptera nodosa*[1]
Whale, Killer	*Grampus rectipinna*
Whale, Right	*Eubalaena sieboldi*
Whale, Sei	*Balaenoptera borealis*[1]
Whale, Sperm	*Physeter catodon*[1]
(see also Porpoise)	
c) Arctic	
Narwhal	*Monodon monocerus*
Seal, Bearded or Squareflipper	*Erignathus barbatus*
Seal, Ringed or Jar	*Phoca hispida*
Walrus, Atlantic	*Odobenus rosmarus*
Walrus, Pacific	*Odobenus divergens*
Whale, Greenland or Bowhead	*Balaena mysticetus*
Whale, White	*Delphinapterus leucas*[1]
(see also Narwhal)	
4. Seaweeds	
a) Atlantic	
Carrageen (see Irish Moss)	
Dulse	*Rhodymenia palmata*[1]
Kelp	*Laminaria spp.*[1]
Moss, Irish	*Chondrus crispus*[1]
Rockweed	*Ascophyllum mackaii*,[1] *etc.*
	Fucus spp.
b) Pacific	
Algae, Red	*Gracilaria spp.*
Kelp	*Macrocystis spp.*
	Nereocystis spp., etc.
5. Marine Bait Worms (Atlantic)	
Bloodworm	*Glycera dibranchiata*[1]
Sandworm	*Neanthes (Nereis) virens*[1]

[1] The superior number indicates species currently utilized in commercial fishing operations, including those caught for bait only but excluding those caught fortuitously in operations for other species and those involved only in "subsistence" fishing. Utilization in the sport fishery is not indicated. In addition, the list includes species possible of exploitation for food or industrial purposes. Some of the commonest trash and forage fishes are also listed, but none of rare or sporadic occurrence. In the case of the Arctic, particularly, the resources have yet to be fully investigated.

TABLES I-VIII

Table I

VALUE OF IMPORTS OF MARINE PRODUCTS, UNITED STATES AND CANADA, 1955

Fresh or Frozen Fish and Shellfish	United States (thousand dollars)	Canada (thousand dollars)
Whole or Dressed		
Whitefish	3,421	—
Yellow pike	880	—
Jacks or grass pike	67	—
Lake trout	672	—
Freshwater trout	987	—
Yellow perch	58	—
Tullibee	18	—
Lake herring	76	—
Mullet	9	—
Saugers	231	—
Blue pike	9	—
Freshwater fish, n.e.s.[1]	2,159	—
Eels	153	—
Salmon	5,488	277
Cod, haddock, etc.	206	75
Halibut	3,187	308
Mackerel	721	[2]
Swordfish	2,000	—
Sturgeon	341	—
Shad	22	—
White bass	85	—
Rosefish	3	—
Fish, n.e.s.[1]	1,183	921
Smelts	1,230	—
Tuna	19,047	—
Sea herring	151	166
Crabmeat, etc.	208	—
Lobster	30,103	225
Crabs	318	—
Clams, quahaugs	548	—
Shrimp and prawns	24,532	—
Scallops	907	—
Oysters	354	490
Abalone	1,359	—
Shellfish n.s.p.f.[3]	308	—
Total	101,041	2,462
Fillets, Blocks or Slabs		
Ocean perch	3,331	—
Cod, filleted	6,883	—
Haddock, hake	5,088	—
Frozen blocks, cod, haddock, etc.	9,466	—
Swordfish, filleted	3,397	—
Halibut and salmon	1,591	—
Freshwater fish, filleted	5,254	—
Flounder	3,847	—
Wolffish	1,449	—
Fish, filleted, n.e.s.[1]	2,089	—
Total	42,395	Nil
Total, Fresh or Frozen Fish or Shellfish	143,436	2,462

[1] n.e.s. means "not elsewhere specified."
[2] Less than $500.
[3] n.s.p.f. means "not specially provided for."

	United States (thousand dollars)	Canada (thousand dollars)
Cured Fish		
Cod, haddock etc. dried or salted	8,029	52
Salmon, pickled, salted	41	3
Herring pickled	3,641	367
Mackerel pickled	531	—
Alewives pickled	24	—
Fish pickled or salted	362	81
Salmon, smoked	7	3
Herring, smoked or kippered	422	—
Cod, smoked or kippered	587	—
Fish, smoked or kippered	17	87
Total	13,661	593
Canned Fish		
Sardines	7,625	—
Anchovies	2,815	1,377
Tuna fish	17,703	467
Salmon	4,555	5
Herring, smoked or kippered	2,243	204
Cod	42	—
Fish, prepared or preserved	2,853	546
Crabmeat, prepared or preserved	4,718	2,081[1]
Lobster	5,073	74
Oysters	673	158
Clams	269	—
Shellfish, n.e.s.[2]	39	—
Total	48,608	4,912
Other Fishery Products		
Fish roe	569	—
Turtles	44	19
Oyster shells, crushed or not	—	383
Seaweeds, moss, grasses and kelp	1,766	—
Frog legs	1,113	—
Fish meal	44	—
Fish offal and refuse	11,797	105
Fish sounds	58	—
Fish solubles	257	—
Fish bones	413	—
Fish livers	76	—
Fish skins	113	—
Seal skins	8	24
Fish products, n.e.s.[2]	1,033	1,442
Sponges marine production	1,188	76
Total	18,479	2,049
Fish Oils		
Cod oil	647	—
Cod liver oil	3,482	139
Herring oil	190	—
Shark and dogfish oil	390	—
Halibut liver oil	24	7
Whale oil	4,965	34
Fish oil, n.e.s.[2]	1,657	2,342
Seal oil	—	1
Total	11,355	2,523
Total, All Marine Products	235,539	12,539

[1] Includes meat from crabs, clams and shrimps.

[2] n.e.s. means "not elsewhere specified".

VOLUME OF PRODUCTION OF SALTED COD (AND RELATED SPECIES)[1], FOR SPECIFIED COUNTRIES, 1948 TO 1955

(metric tons, dried weight)

Year	Total twelve countries	Canada[2]	Faroe Islands (Denmark)	France[3]	Greenland (Denmark)	Iceland	New-found land[4]	Norway	Portugal	Spain	Italy	U.K.[5]	U.S.A.[6]
1948	216,873	30,584	19,928[3]	28,844	4,666	10,578	47,754	27,300	24,522	20,000	47	1,650	1,000
1949	252,129	31,948	23,667	35,121	5,267	12,667	53,342	35,000	32,139	20,000	43	1,935	1,000
1950	284,977	29,271	25,833	36,593	5,552	32,667	43,182	43,333	36,879	23,333	2,533	4,801	1,000
1951	285,107	24,655	20,433	36,009	3,800	21,000	45,918	55,333	35,638	33,333	2,533	5,455	1,000
1952	307,339	27,654	21,580	43,773	4,567	42,000	40,221	49,333	37,067	33,333	2,170	4,641	1,000
1953	277,304	26,724	17,204	39,488	3,933	31,600	35,756	36,333	45,119	33,666	2,543	3,938	1,000
1954	274,315	29,001	14,200	43,365	3,333	25,666	38,719	35,000	44,198	33,333	2,487	4,013	1,000
1955	299,989	26,000	21,666	46,202	3,840	31,666	30,200	41,666	48,002	42,000	1,380	6,367	1,000

[1] **Stockfish not included.**
[2] **Excluding Newfoundland.**
[3] **Includes St. Pierre and Miquelon.**
[4] **Newfoundland became a province of Canada on April 1, 1949.**
[5] **Exports only.**
[6] **Estimated.**

SOURCES: Annual Reviews of Salted Fish Production and the European Markets, Hawes & Co., (London) Ltd.; Canadian Trade Commissioner Service Reports.

Table III

VOLUME OF IMPORTS OF SALTED COD (AND RELATED SPECIES), FOR PRINCIPAL IMPORTING COUNTRIES, 1947 TO 1955

(metric tons, product weight)

Year	Total twelve countries	Argentina	Brazil	Cuba[1]	Portugal	Spain	Italy	Greece	France	U.S.A.[2]	Dominican Republic	Puerto Rico[3]	Jamaica
1947	154,344	2,909	14,533	6,962[4]	33,895	7,306	52,146	8,245	555	9,277	1,134[5]	11,495	5,887[6]
1948	161,714	—	18,651	9,758	26,549	5,667	54,616	13,070	500[5]	10,870	1,134[5]	15,765	5,134[6]
1949	147,204	—	21,194	11,740	27,610	8,160	39,208	10,417	500[5]	9,572	1,199[3]	12,542	5,062[6]
1950	176,768	—	25,315	11,956	25,150	20,108	50,437	11,772	500[5]	10,619	2,155	14,316	4,440[6]
1951	203,499	757	40,474	13,168	20,617	20,109	55,549	18,337	500[5]	9,551	3,826	15,127	5,484
1952	163,528	72	22,911	12,245	10,062	21,034	54,840	8,830	500[5]	10,397	3,095[3]	14,643	4,899
1953	144,221	—	14,975	13,606	17,094	19,374	33,063	15,101	500[5]	8,518	3,573[3]	12,194	6,223[6]
1954	146,335	722	21,638	12,631	9,121	16,550	39,516	9,585	500[5]	7,930	4,325[3]	16,311	7,506[6]
1955	170,090	195	27,788	13,128	14,869	17,790	51,473	11,193	500[5]	7,484	3,270[3]	14,531	7,869[6]

[1] Includes some stockfish.
[2] Based upon exports from producing countries.
[3] Based on exports from Canada (including Newfoundland) Iceland and France only.
[4] Based on exports from Newfoundland and Norway — import data not available for 1947.
[5] Estimated.
[6] Based on exports from Canada (including Newfoundland). Imports from other countries, principally the U.K., were small.

SOURCES: Annual Reviews of Salted Fish Production and the European Markets, Hawes & Co., (London) Ltd; Official National Trade Statistics; Canadian Trade Commissioner Service Reports.

CONSUMPTION, TOTAL AND PER CAPITA, OF SALTED COD (AND RELATED SPECIES) SELECTED COUNTRIES, SPECIFIED YEARS

Year	Jamaica		Puerto Rico		Cuba		Brazil		Spain		Portugal		Italy	
	Total Cons. (million lb.)	Per Capita Consumption (lb.)	Total Cons. (million lb.)	Per Capita Consumption (lb.)	Total Cons. (million lb.)	Per Capita Consumption (lb.)	Total Cons. (million lb.)	Per Capita Consumption (lb.)	Total Cons. (million lb.)	Per Capita Consumption (lb.)	Total Cons. (million lb.)	Per Capita Consumption (lb.)	Total Cons. (million lb.)	Per Capita Consumption (lb.)
1920	[1]	[1]	[1]	[1]	[1]	[1]	65.1	2.4	121.8	5.7	75.6	12.5	85.7	2.3
1925	[1]	[1]	[1]	[1]	[1]	[1]	50.2	1.7	156.3	7.0	85.2	13.3	79.2	2.1
1930	[1]	[1]	[1]	[1]	[1]	[1]	78.0	2.3	143.1	6.1	95.1	13.9	69.1	1.7
1935	[1]	[1]	[1]	[1]	15.5	3.7	37.8	1.0	123.5	5.0	108.7	15.0	74.3	1.8
1940	11.5	9.7	[1]	[1]	11.9	2.6	36.4	0.9	29.7	1.2	89.2	11.6	69.8	1.6
1945	[1]	[1]	[1]	[1]	5.6	1.1	3.9	0.1	46.3	1.7	64.4	8.0	0.1	[2]
1950	9.8[3]	7.0	31.6	14.3	26.4	4.9	55.8	1.1	88.4	3.2	126.1	15.0	111.2	2.4
1951	12.1	8.5	33.3	14.9	27.5	5.0	89.2	1.7	117.8	4.2	127.3	15.0	130.9	2.8
1952	10.8	7.4	32.3	14.4	27.0	4.5	[1]	[1]	119.9	4.2	110.3	12.9	128.1	2.7
1953	13.7[3]	9.2	26.9	12.1	30.0	5.1	[1]	[1]	117.0	4.1	127.8	14.8	81.3	1.7
1954	15.7[3]	10.5	36.0	15.9	27.9	4.7	47.7	0.8	106.6	3.7	127.0	14.6	95.4	2.0
1955	17.3[3]	11.2	32.0	13.9	28.9	4.7	61.3	1.0	131.8	4.5	137.3	15.7	121.6	2.5

[1] Not available. [2] Negligible. [3] Canadian exports only. Imports from other countries, principally the United Kingdom, were small.

Table V

NUMBERS AND VALUE OF CAPITAL EQUIPMENT OF THE PRIMARY FISHERIES OF CANADA, (Excluding Newfoundland) 1940 to 1954

Year	Vessels		Boats		Total Craft		Value of Gear and Shore Equipment	Total Value
	no.	value	no.	value	no.	value		
		(thousand dollars)		(thousand dollars)		(thousand dollars)	(thousand dollars)	(thousand dollars)
1940	1,083	3,667	38,463	10,698	39,546	14,365	11,856	26,221
1941	1,163	5,067	36,545	10,267	37,708	15,334	12,222	27,556
1942	1,274	5,862	36,942	10,578	38,216	16,440	12,638	29,078
1943	1,324	6,286	36,718	10,929	38,042	17,215	13,905	31,120
1944	1,581	8,619	36,574	11,021	38,155	19,640	15,417	35,057
1945	1,794	12,229	36,621	12,353	38,415	24,582	16,361	40,943
1946	1,963	13,229	38,667	15,972	40,630	29,201	18,212	47,413
1947	2,179	18,792	35,655	18,899	37,834	37,691	20,898	58,589
1948	2,285	22,942	35,775	19,248	38,060	42,190	25,100	67,290
1949	2,143	21,796	36,120	22,087	38,263	43,883	25,612	69,495
1950	2,232	26,855	36,280	24,181	38,512	51,036	29,082	80,118
1951	2,331	32,155	36,048	27,576	38,379	59,731	32,696	92,427
1952	2,369	37,590	35,255	29,620	37,624	67,210	35,732	102,942
1953	2,272	37,691	33,807	32,789	36,079	70,480	34,227	104,707
1954	2,231	38,239	34,277	32,290	36,508	70,529	35,811	106,340

Table VI

DISTRIBUTION OF NUMBERS AND GROSS SALES OF FISH PROCESSING ESTABLISHMENTS CLASSIFIED BY VALUE OF PRODUCTION, WITH PERCENTAGES, ATLANTIC AND PACIFIC REGIONS OF CANADA,[1] 1954

(a)

Value of production (dollars)	Number of Establishments			
	Atlantic Region		Pacific Region	
	no.	%	no.	%
Under 10,000	119	23.6	5	6.1
10,000 to 24,999	73	14.5	9	11.0
25,000 to 49,999	81	16.0	12	14.6
50,000 to 99,999	77	15.3	10	12.2
100,000 to 199,999	73	14.5	6	7.3
200,000 to 499,999	46	9.1	10	12.2
500,000 to 999,999	16	3.2	9	11.0
1,000,000 to 4,999,999	19	3.8	19	23.2
5,000,000 and over	—	—	2	2.4
Total	504	100.0	82	100.0

(b)

Value of production (dollars)	Gross Value of Sales			
	Atlantic Region		Pacific Region	
	(thousand dollars)	%	(thousand dollars)	%
Under 10,000	573.6	0.7	21.6	0.0
10,000 to 24,999	1,156.4	1.4	163.4	0.2
25,000 to 49,999	3,035.2	3.7	435.9	0.6
50,000 to 99,999	5,563.4	6.8	700.1	1.0
100,000 to 199,999	10,338.3	12.5	726.6	1.0
200,000 to 499,999	14,841.0	18.0	3,365.2	4.7
500,000 to 999,999	11,202.4	13.6	6,498.1	9.2
1,000,000 to 4,999,999	35,677.6	43.3	59,157.8	83.3
5,000,000 and over	—	—	—	—
Total	82,387.9	100.0	71,068.7	100.0
Average value of sales per establishment	163.5		866.7	

[1] Includes a few firms engaged in marketing but not processing.

Table VII

NUMBERS OF FISHERMEN[1], CANADA AND NEWFOUNDLAND, 1937 TO 1954

Year	Canada, excluding Newfoundland	Newfoundland	Canada, including Newfoundland
	(thousand)	(thousand)	(thousand)
1937	70.0	20.8	90.8
1938	71.5	23.8	95.3
1939	68.9	23.6	92.5
1940	68.8	21.3	90.1
1941	63.7	17.4	81.2
1942	61.4	16.5	77.9
1943	61.5	18.7	80.2
1944	64.2	21.0	85.2
1945	67.7	23.2	91.0
1946	73.5	24.5	98.0
1947	65.4	26.3	91.7
1948	66.1	26.2	92.3
1949	64.7	25.0	89.7
1950	64.9	21.1	86.0
1951	67.1	19.6	86.7
1952	64.3	17.8	82.1
1953	62.1	16.8	78.9
1954	63.4	16.3	79.7

[1] **There are still a number of obstacles to be overcome in establishing a satisfactory time series for number of fishermen for Canada as a whole. At the same time, the above series is considered to give a satisfactory indication of the trend in such numbers, particularly if Newfoundland is excluded. This report is, of course, concerned mainly with the trend rather than with precise numbers.**

Table VIII

EMPLOYMENT IN FISH PROCESSING PLANTS, PACIFIC COAST AND MARITIMES AND QUEBEC, 1917 TO 1954

Year	Number of Employees		
	Pacific Coast	Maritimes and Quebec	Total
	(thousand)	(thousand)	(thousand)
1917	7.6	10.4	18.0
1918	8.9	9.6	18.5
1919	7.9	10.4	18.3
1920	7.2	11.3	18.5
1921	5.1	9.0	14.1
1922	6.3	10.3	16.6
1923	6.1	9.3	15.4
1924	6.9	8.6	15.5
1925	7.4	8.8	16.2
1926	8.4	9.0	17.4
1927	8.2	8.5	16.7
1928	7.2	8.2	15.4
1929	7.8	8.6	16.4
1930	7.3	8.4	15.7
1931	4.4	8.6	13.1
1932	4.7	9.0	13.7
1933	5.8	8.2	14.0
1934	6.2	8.6	14.8
1935	6.1	8.3	14.4
1936	6.6	8.6	15.2
1937	5.6	8.4	14.0
1938	6.1	8.4	14.5
1939	6.3	8.5	14.8
1940	7.4	7.6	15.0
1941	7.9	7.9	15.8
1942	6.9	8.8	15.7
1943	6.0	9.9	15.9
1944	6.2	11.1	17.3
1945	6.0	11.5	17.5
1946	6.1	13.3	19.4
1947	5.0	11.4	16.4
1948	4.2	12.3	16.5
1949	4.2	11.9	16.1
1950	3.9	11.0	14.9
1951	4.6	11.5	16.1
1952	4.0	11.0	15.0
1953	3.8	10.0	13.8
1954[1]	4.4	10.4	14.8

[1] 1954 data adjusted to basis of previous years.

Appendix D

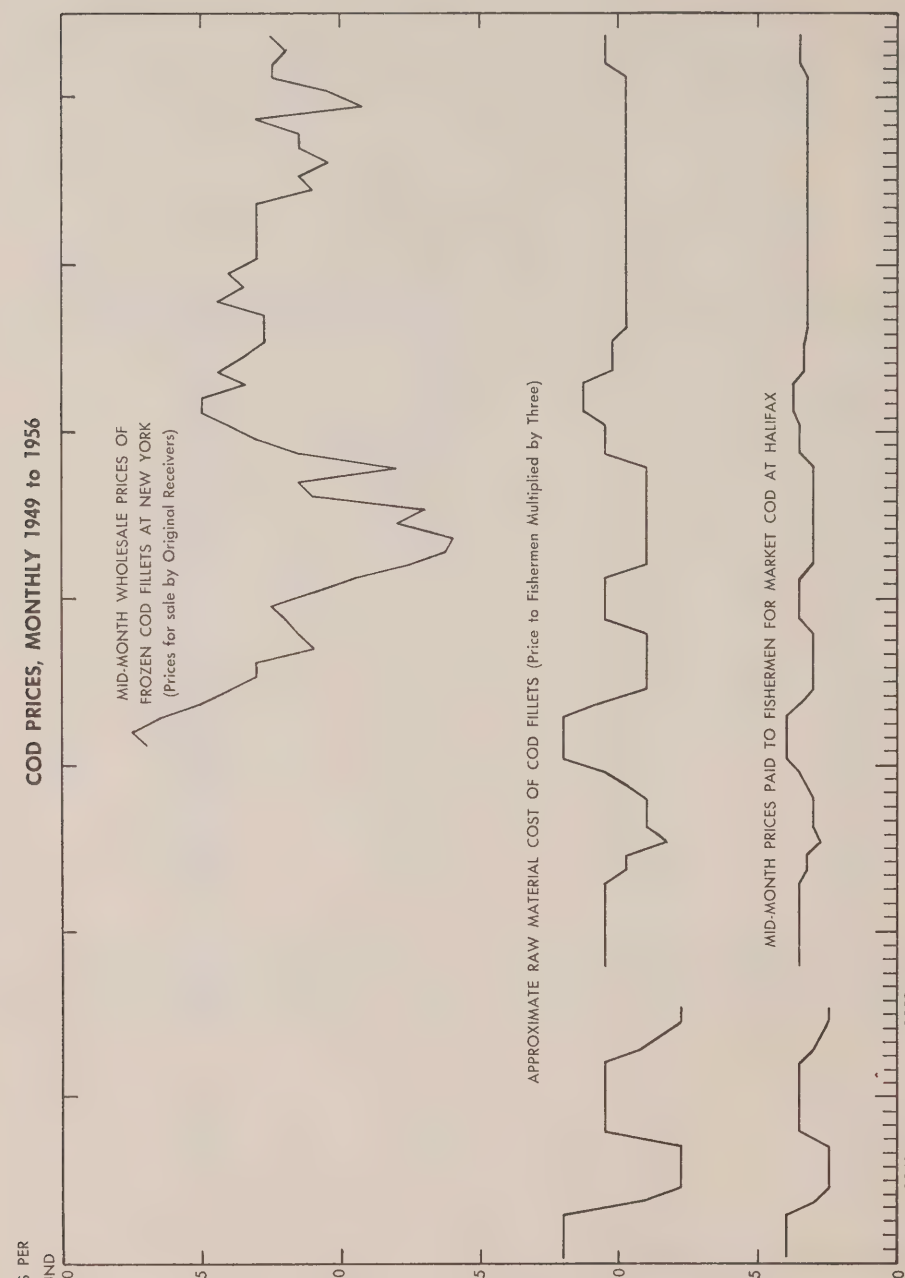


FIGURE 1

INDEXES OF WHOLESALE PRICES OF FISHERY PRODUCTS, GENERAL WHOLESALE PRICES, AND DISPOSABLE INCOME PER PERSON, CANADA 1935 – 55

(1935 – 39 = 100)

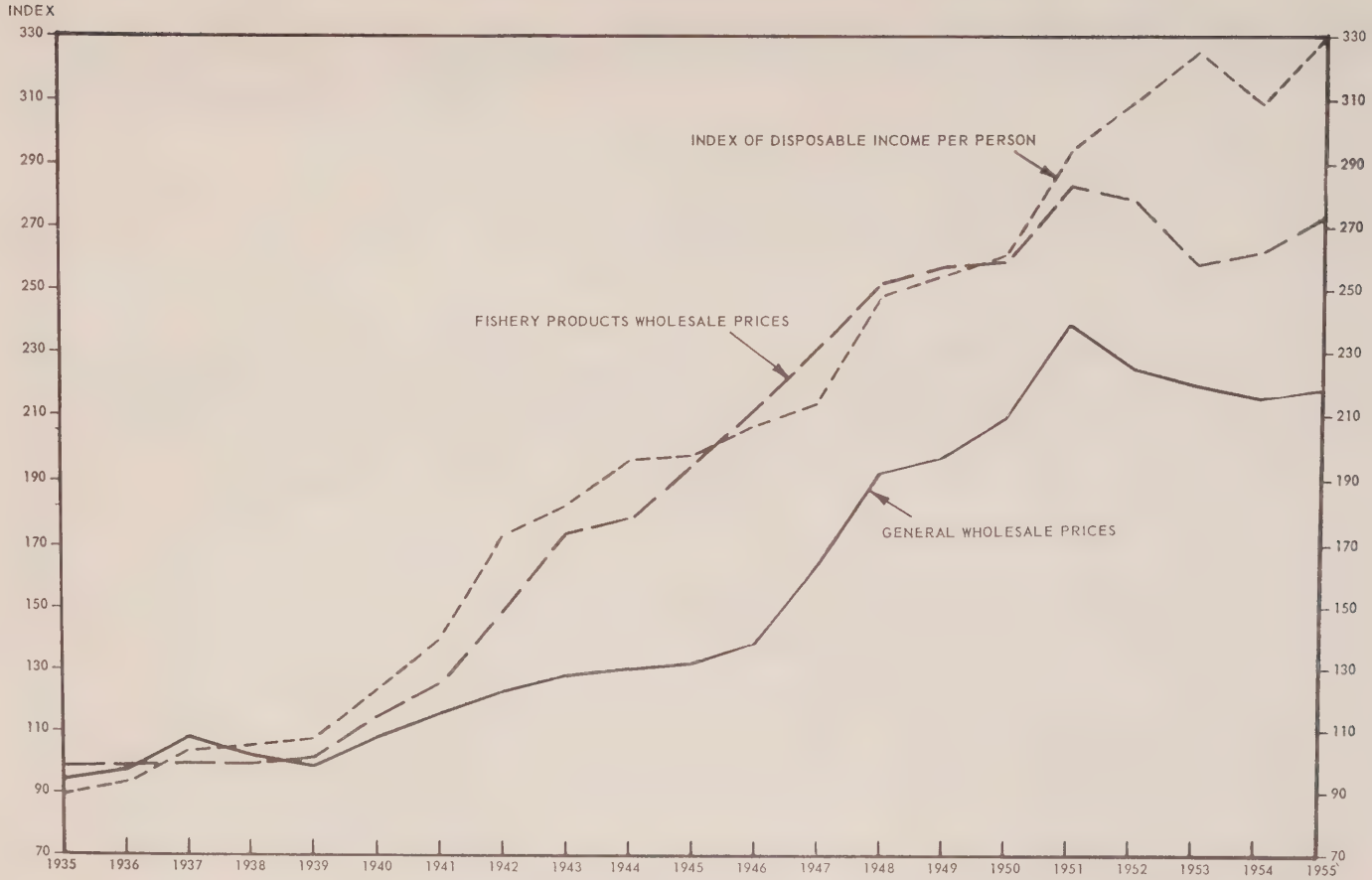


FIGURE 2

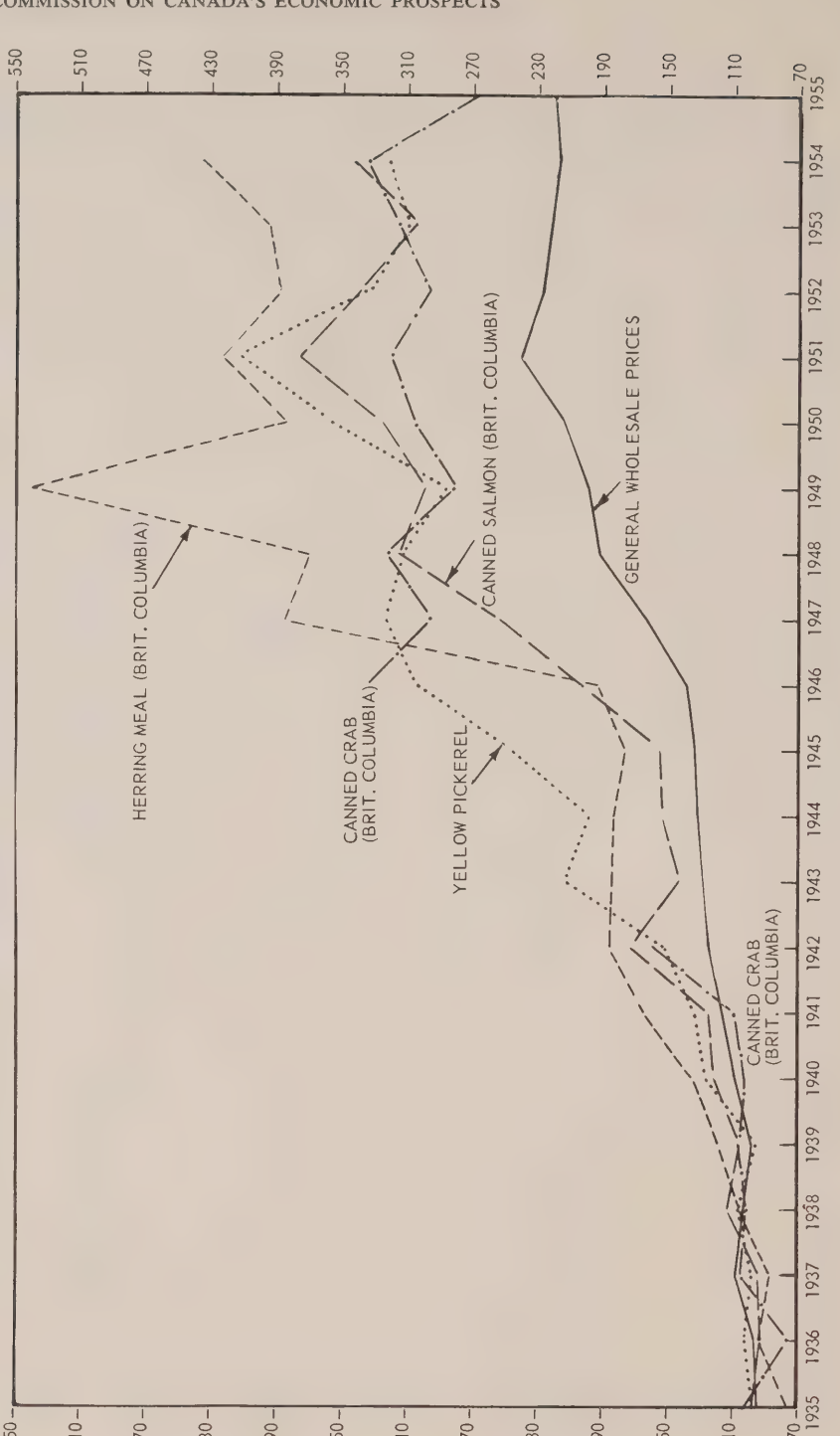

INDEXES OF PRICES OF SPECIFIED FISHERY PRODUCTS AND GENERAL WHOLESALE PRICES
CANADA 1935 – 55
(1935 – 39 = 100)
INDEX
550
510
470
430
390
350
310
270
230
190
150
110
70
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
HERRING MEAL (BRIT. COLUMBIA)
CANNED CRAB (BRIT. COLUMBIA)
YELLOW PICKEREL
CANNED SALMON (BRIT. COLUMBIA)
GENERAL WHOLESALE PRICES
CANNED CRAB (BRIT. COLUMBIA)

FIGURE 3

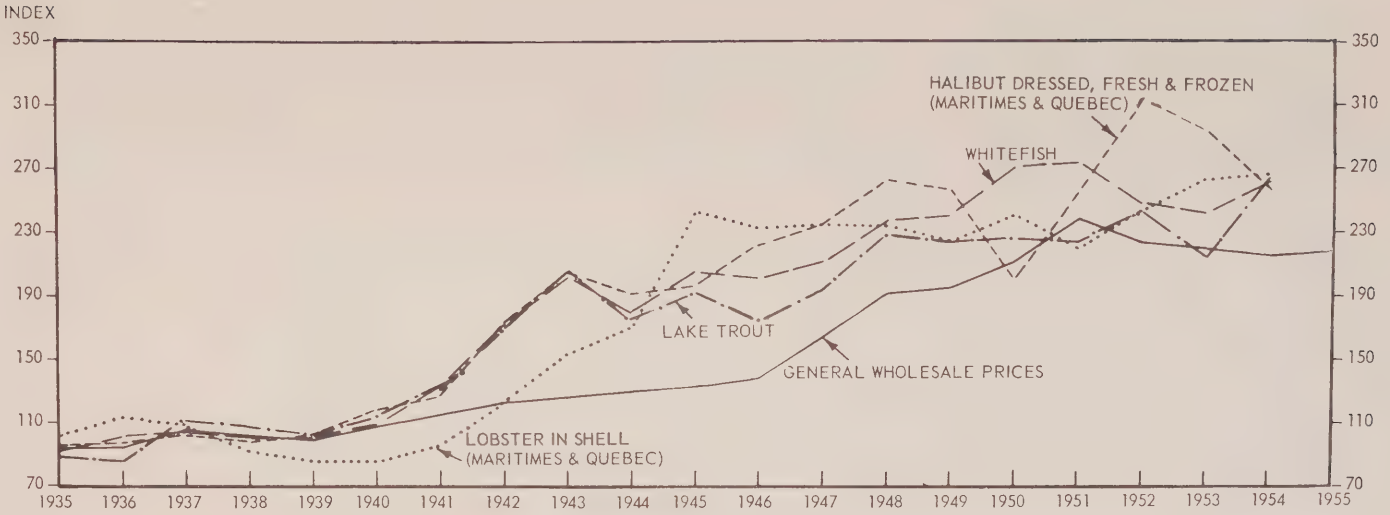


FIGURE 4

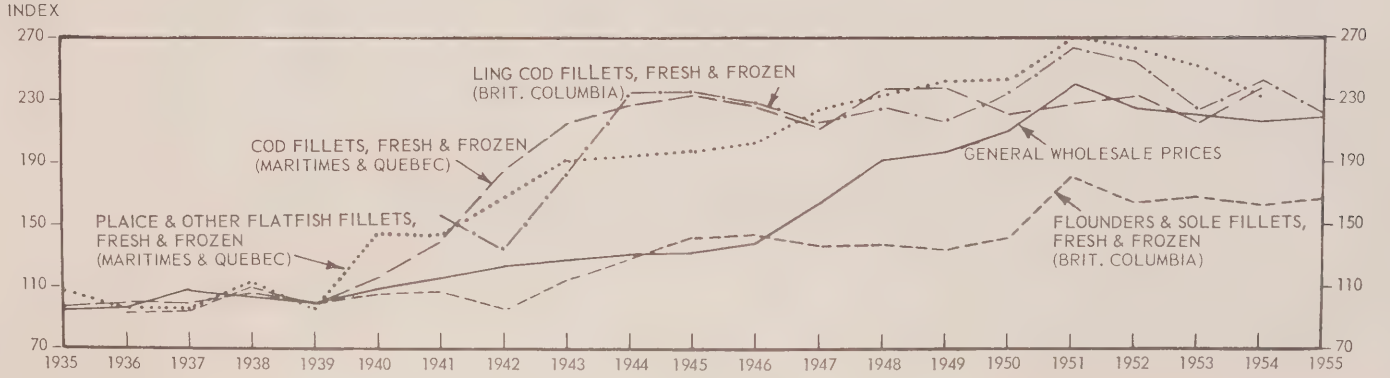


FIGURE 5

MONTHLY INDEXES OF GENERAL WHOLESALE PRICES AND FISHERY PRODUCTS WHOLESALE PRICES, CANADA, 1949 to 1955

(1949 = 100)

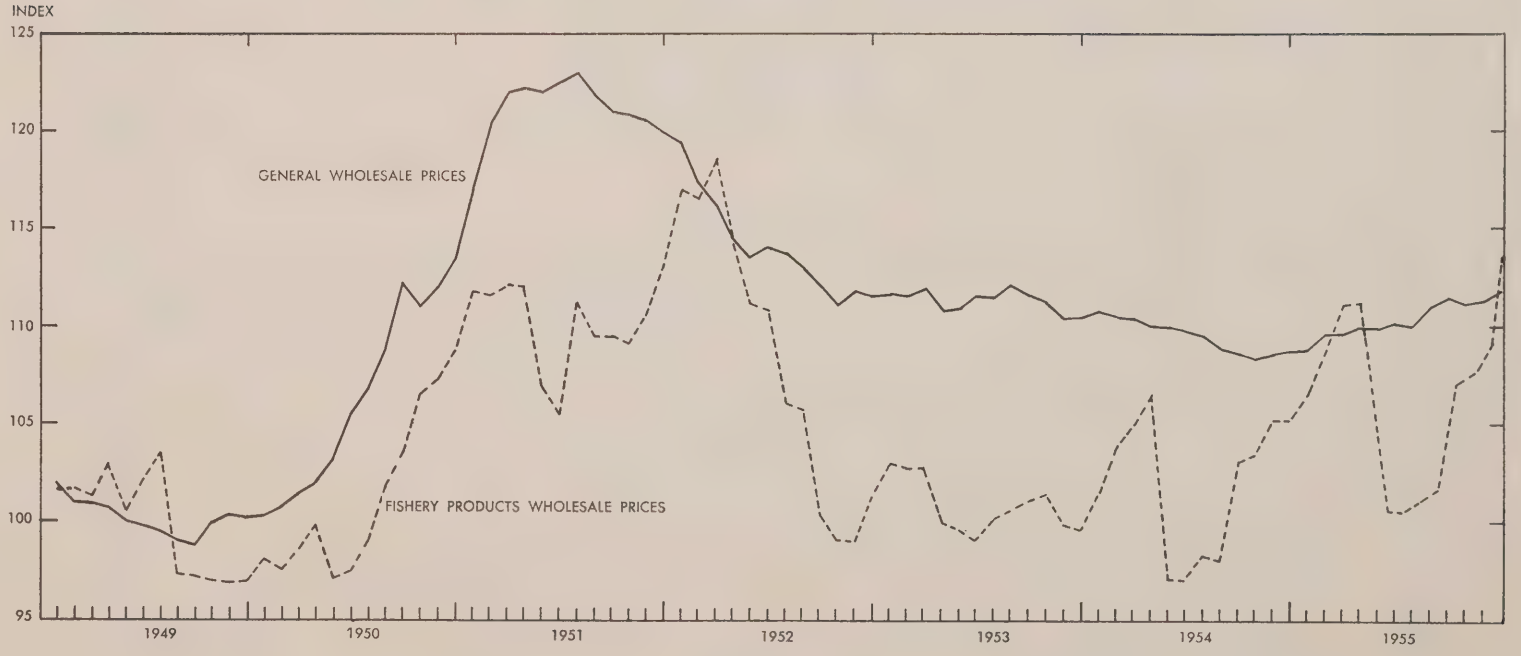


FIGURE 6

INDEXES OF PRICES PAID TO FISHERMEN FOR SELECTED SPECIES OF FISH AND OF GENERAL WHOLESALE PRICES, CANADA, 1949 to 1955 (1949 = 100)

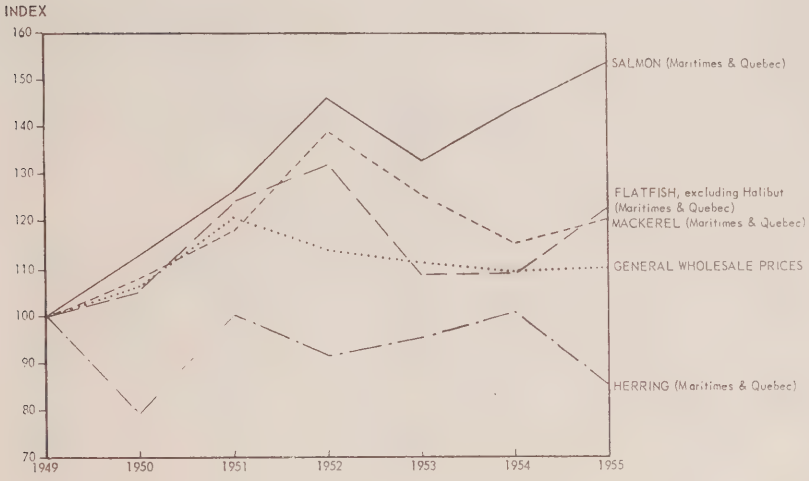


FIGURE 7

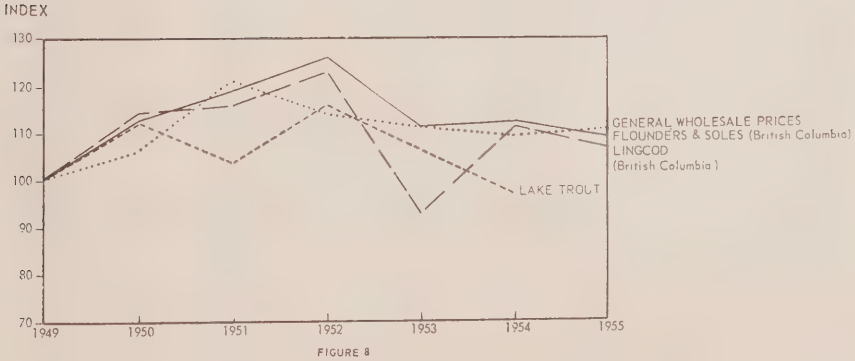


FIGURE 8

(Continued on page 158)

(Continued from page 157)

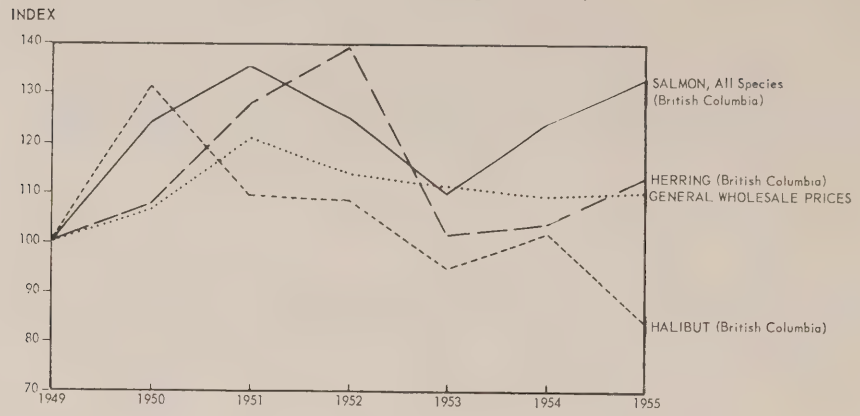


FIGURE 9

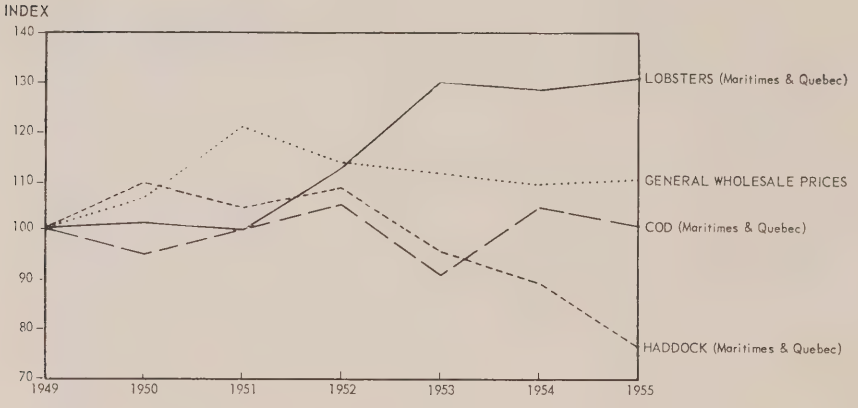


FIGURE 10

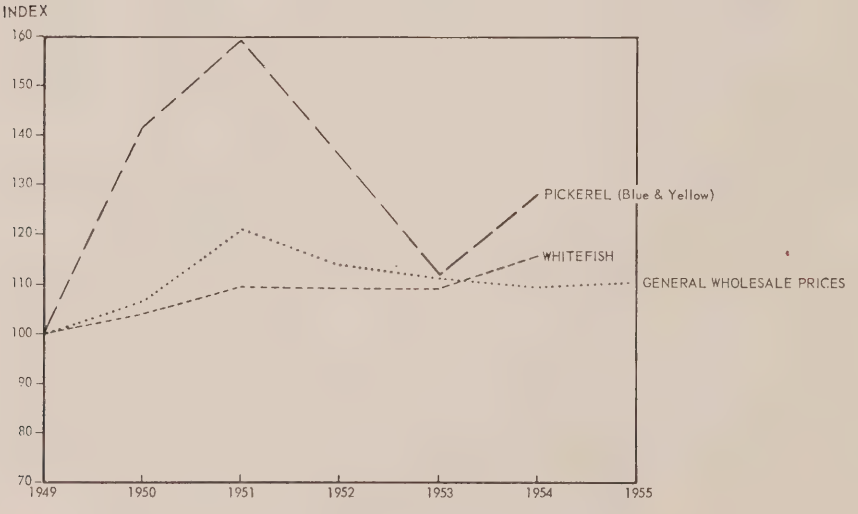


FIGURE 11

APPENDIX D

CANADIAN EXPORTS OF LOBSTERS IN SHELL AND UNITED STATES POPULATION 1946 to 1955

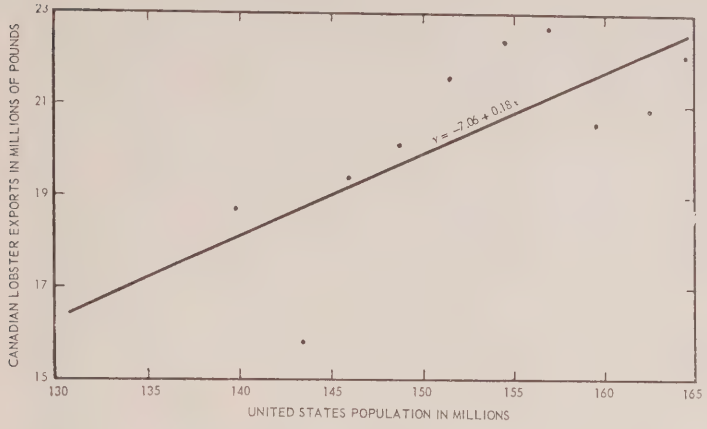


FIGURE 12

	UNITED STATES POPULATION (MILLION)	CANADIAN LOBSTER EXPORTS (MILLION POUNDS)
1946	139.9	18.7
1947	143.4	15.8
1948	146.1	19.4
1949	148.7	20.1
1950	151.4	21.6
1951	154.4	22.4
1952	157.0	22.7
1953	159.6	20.6
1954	162.4	20.9
1955	164.5	22.1
1980	230.0*	34.3**

CANADIAN EXPORTS OF GROUNDFISH FILLETS (Fresh and Frozen) AND UNITED STATES POPULATION, 1949 to 1955

	UNITED STATES POPULATION (MILLION)	CAN. GROUNDFISH FILLET EXPORTS (MILLION POUNDS)
1949	148.7	39.3
1950	151.4	48.0
1951	154.4	58.0
1952	157.0	57.3
1953	159.6	62.7
1954	162.4	74.0
1955	164.5	99.6
1980	230.0*	292.9**

* ESTIMATED

** COMPUTED FROM REGRESSION LINE

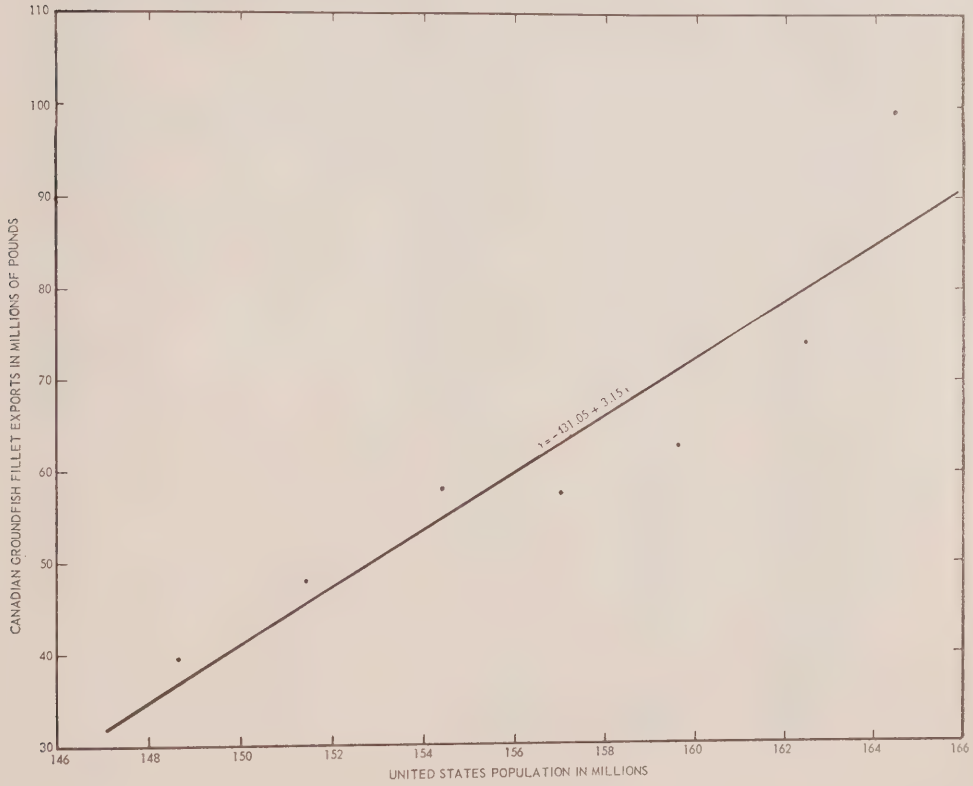
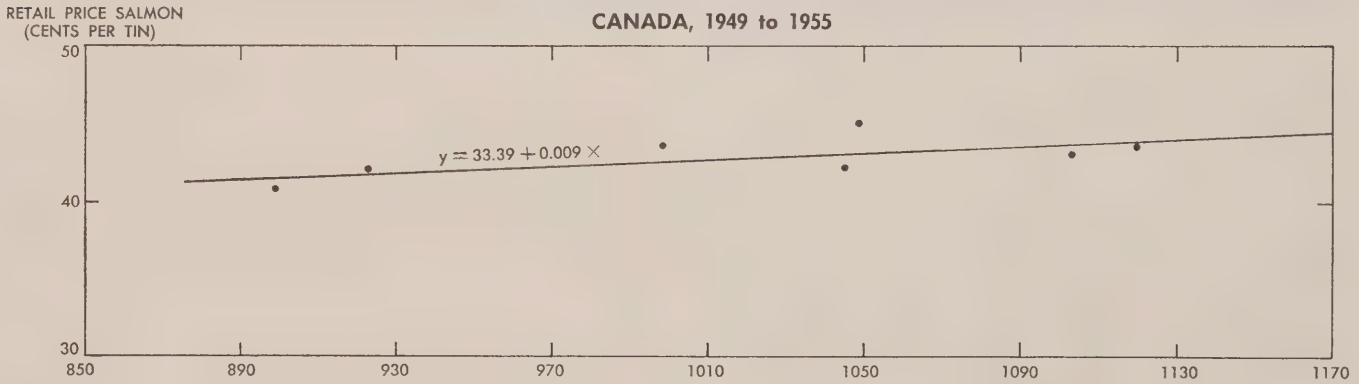


FIGURE 13

AVERAGE YEARLY RETAIL PRICE, SOCKEYE SALMON, GRADE A, AT MONTREAL, AND DISPOSABLE INCOME PER PERSON, CANADA, 1949 to 1955



	DISPOSABLE INCOME PER PERSON (CURRENT DOLLARS)	SALMON RETAIL PRICE (CENTS PER TIN)
1949	899	40.7
1950	923	42.0
1951	1,038	43.4
1952	1,089	45.0
1953	1,143	42.8
1954	1,085	42.2
1955	1,160	43.6

FIGURE 14

MONTHLY WHOLESALE PRICES OF BACON SIDES, GOOD STEERS AND FROZEN COD FILLETS, TORONTO, 1949 to 1956

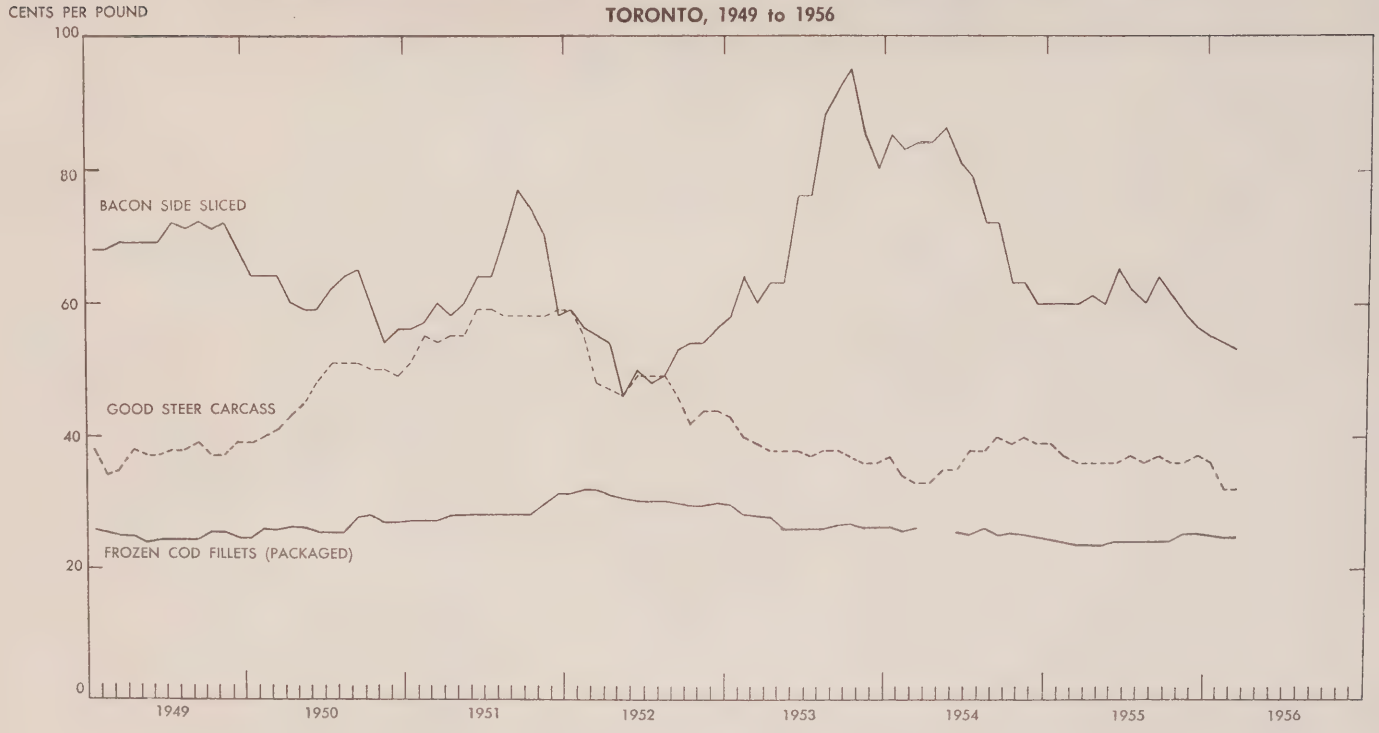
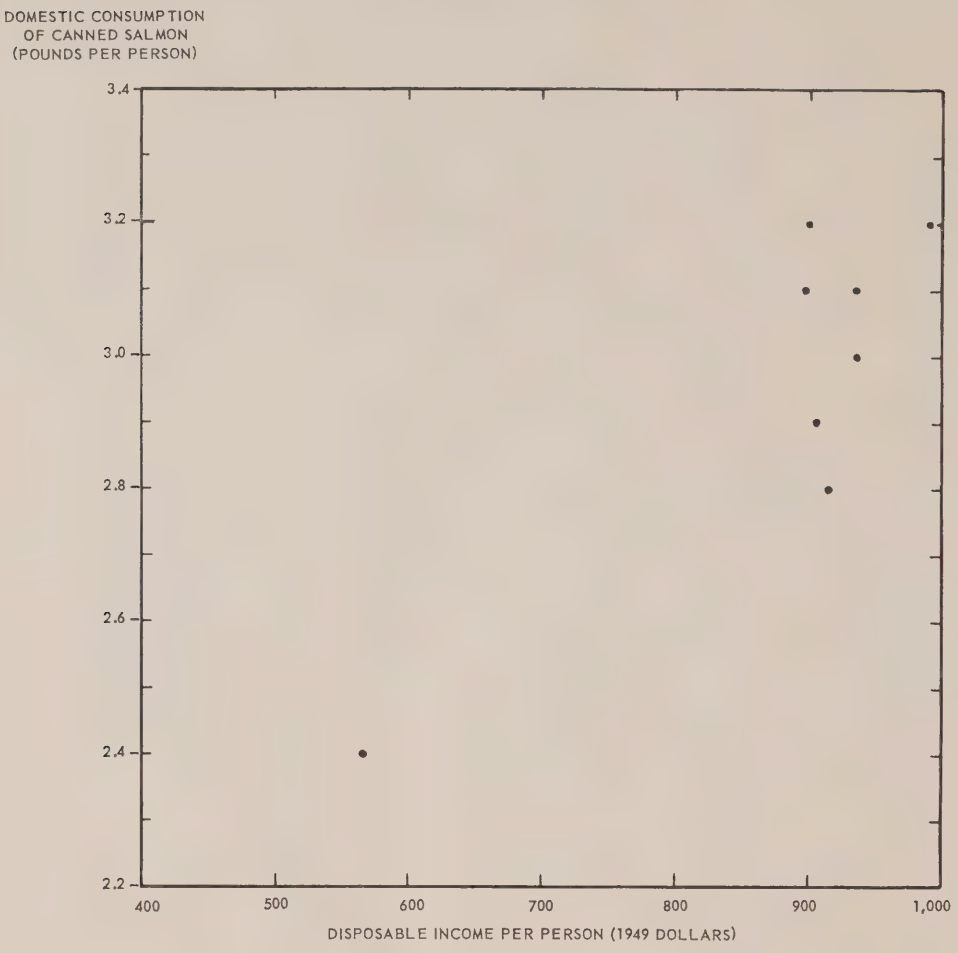


FIGURE 15

DOMESTIC CONSUMPTION OF CANNED SALMON AND DISPOSABLE INCOME, CANADA, 1935 - 39 AVERAGE AND 1948 to 1954



	DISPOSABLE INCOME PER PERSON (1949 DOLLARS)	DOMESTIC CONSUMPTION PER PERSON (POUNDS)
1935 – 39	566	2.4
1948	904	2.9
1949	899	3.2
1950	897	3.1
1951	913	2.8
1952	935	3.0
1953	990	3.2
1954	934	3.1

FIGURE 16

DOMESTIC CONSUMPTION OF CANNED SALMON AND POPULATION, CANADA, 1948 – 54

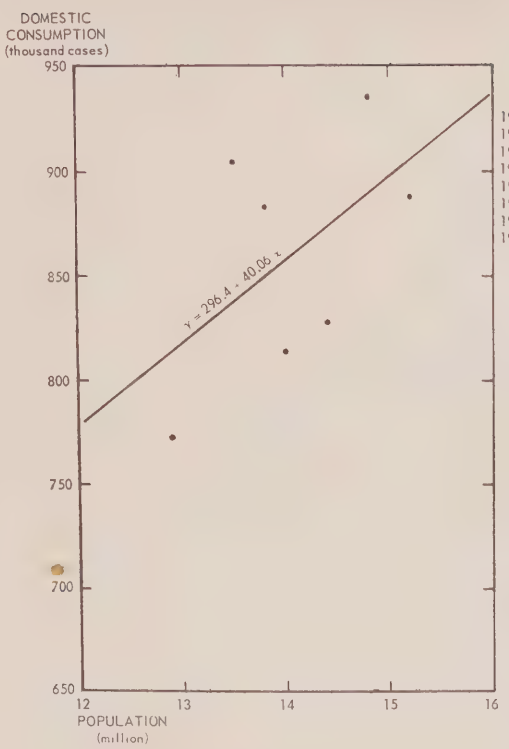


FIGURE 17

	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (thousand cases)
1948	12.9	773
1949	13.5	905
1950	13.8	883
1951	14.0	814
1952	14.4	828
1953	14.8	935
1954	15.2	887
1980	26.6*	1,362**

DOMESTIC CONSUMPTION OF SALMON, FRESH, ROUND OR DRESSED, AND POPULATION, CANADA, 1949 – 55

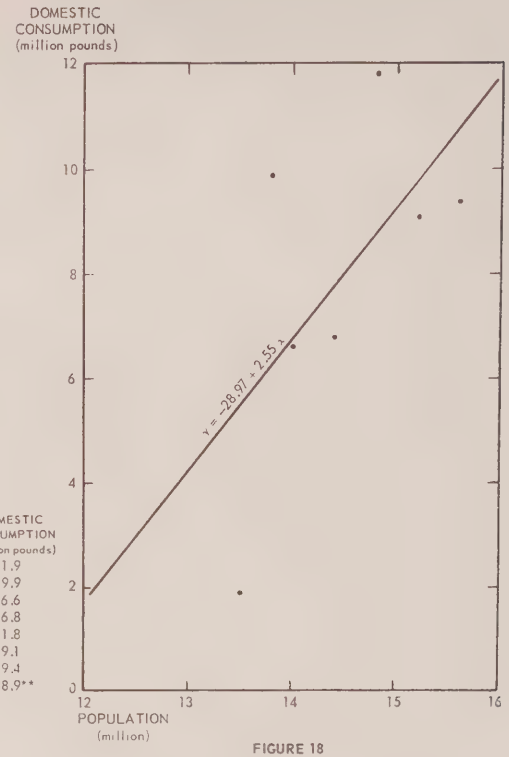


FIGURE 18

	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	1.9
1950	13.8	9.9
1951	14.0	6.6
1952	14.4	6.8
1953	14.8	11.8
1954	15.2	9.1
1955	15.6	9.4
1980	26.6*	38.9**

* ESTIMATED
** COMPUTED FROM REGRESSION LINE

DOMESTIC CONSUMPTION OF SALMON, FROZEN, ROUND OR DRESSED, AND POPULATION, CANADA, 1949 – 55

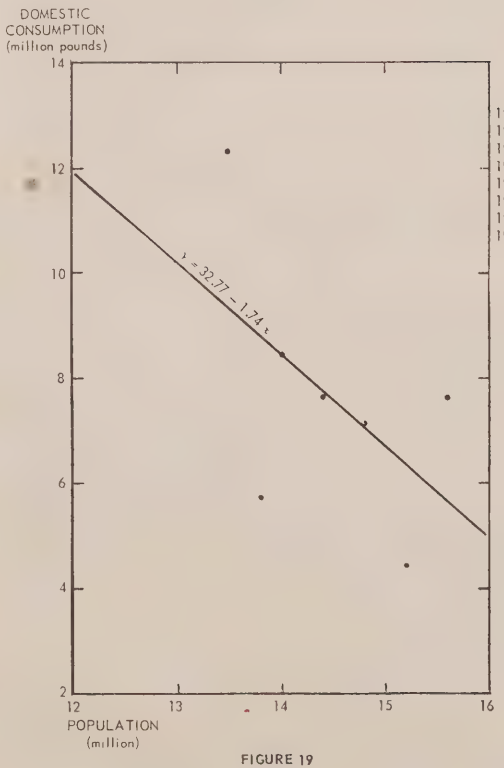


FIGURE 19

	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	12.3
1950	13.8	5.7
1951	14.0	8.4
1952	14.4	7.6
1953	14.8	7.1
1954	15.2	4.4
1955	15.6	7.6
1980	26.6*	–13.5**

DOMESTIC CONSUMPTION OF HALIBUT, FRESH, ROUND OR DRESSED, AND POPULATION, CANADA, 1949 – 55

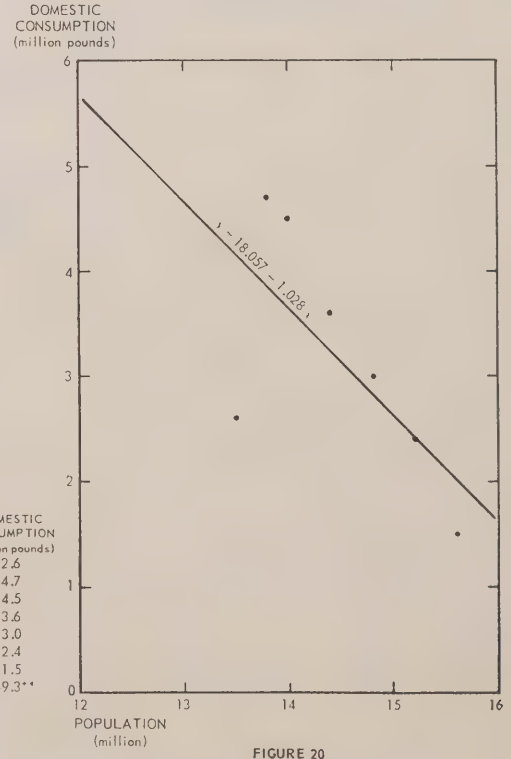


FIGURE 20

	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	2.6
1950	13.8	4.7
1951	14.0	4.5
1952	14.4	3.6
1953	14.8	3.0
1954	15.2	2.4
1955	15.6	1.5
1980	26.6*	–9.3**

* ESTIMATED
** COMPUTED FROM REGRESSION LINE

DOMESTIC CONSUMPTION OF HALIBUT, FROZEN, ROUND OR DRESSED, AND POPULATION, CANADA, 1949 to 1955

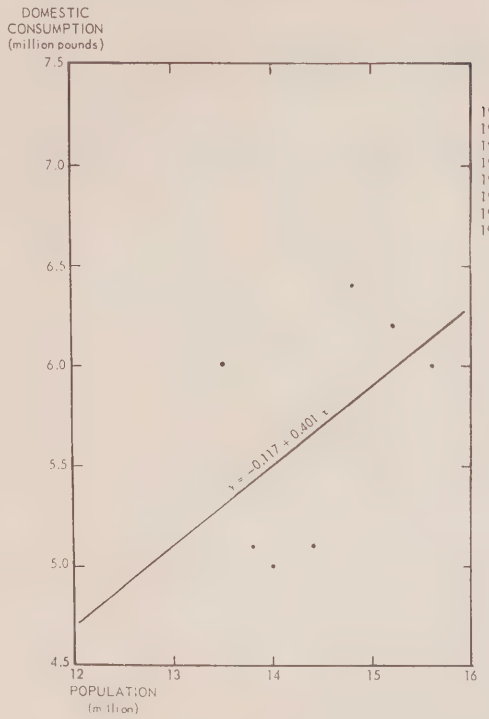


FIGURE 21

	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	6.0
1950	13.8	5.1
1951	14.0	5.0
1952	14.4	5.1
1953	14.8	6.4
1954	15.2	6.2
1955	15.6	6.0
1980	26.6*	10.6**

DOMESTIC CONSUMPTION OF FRESH AND FROZEN, ROUND OR DRESSED FISH, ALL SPECIES, AND POPULATION, CANADA, 1949 to 1955

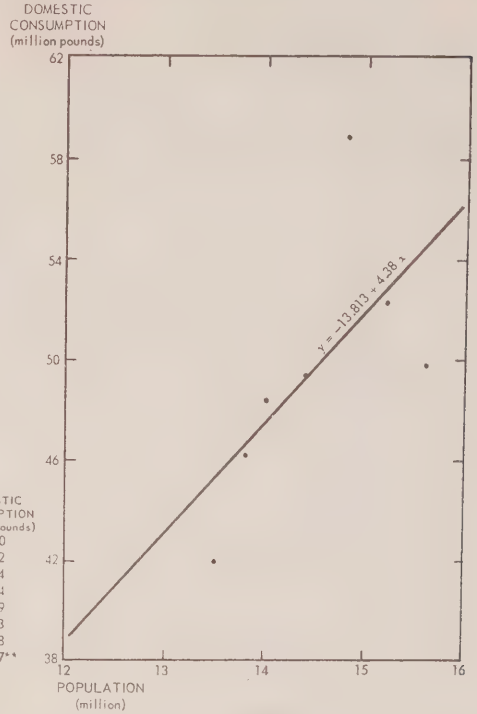
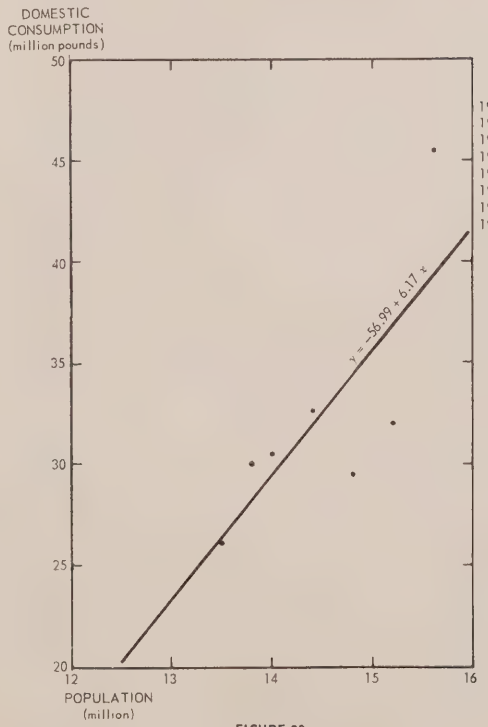


FIGURE 22

	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	42.0
1950	13.8	46.2
1951	14.0	48.4
1952	14.4	49.4
1953	14.8	58.9
1954	15.2	52.3
1955	15.6	49.8
1980	26.6*	102.7**

* ESTIMATED
** COMPUTED FROM REGRESSION LINE

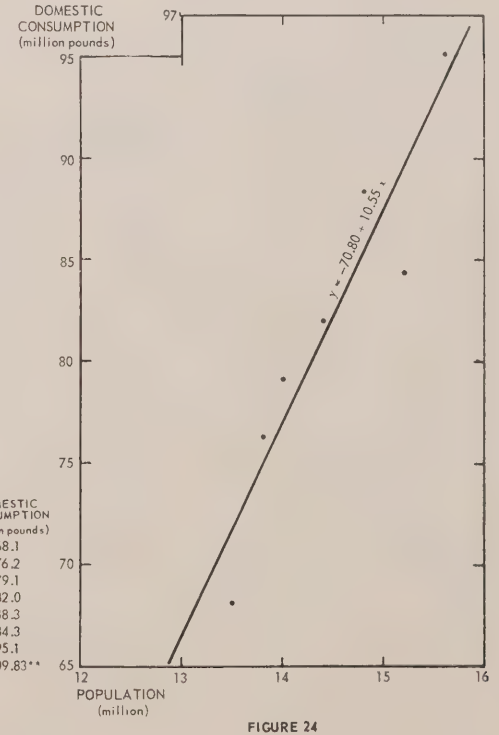
DOMESTIC CONSUMPTION OF GROUNDFISH FILLETS, FRESH AND FROZEN, AND POPULATION, CANADA, 1949 to 1955



	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	26.1
1950	13.8	30.0
1951	14.0	30.7
1952	14.4	32.6
1953	14.8	29.4
1954	15.2	32.0
1955	15.6	45.3
1980	26.6*	107.1**

FIGURE 23

DOMESTIC CONSUMPTION OF FISH, FRESH AND FROZEN, ROUND OR DRESSED, AND FILLETS, ALL SPECIES, AND POPULATION, CANADA, 1949 to 1955

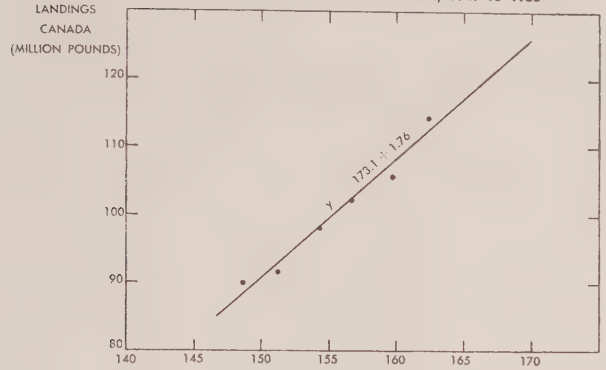


	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	68.1
1950	13.8	76.2
1951	14.0	79.1
1952	14.4	82.0
1953	14.8	88.3
1954	15.2	84.3
1955	15.6	95.1
1980	26.6*	209.83**

FIGURE 24

* ESTIMATED
** COMPUTED FROM REGRESSION LINE

LANDINGS OF FRESHWATER FISH, ALL SPECIES, CANADA, AND UNITED STATES POPULATION, 1949 to 1955

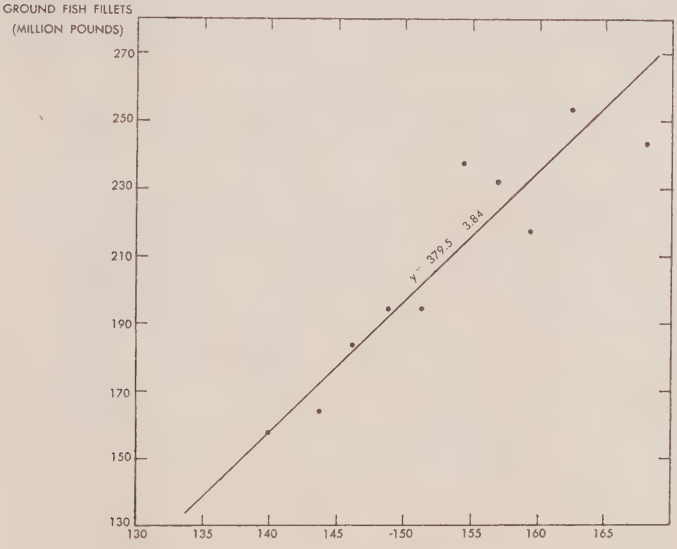


	UNITED STATES POPULATION (Million)	LANDINGS FRESHWATER FISH, CANADA (Million Pounds)
1949	148.7	90.2
1950	151.4	92.0
1951	154.4	98.4
1952	157.0	102.9
1953	159.6	106.2
1954	162.4	114.4
1980	230.0*	231.7**

FIGURE 25

*Estimated
**Computed from Regression line

CONSUMPTION OF GROUND FISH FILLETS (NOT INCLUDING FLATFISH) AND POPULATION, UNITED STATES, 1946 to 1955

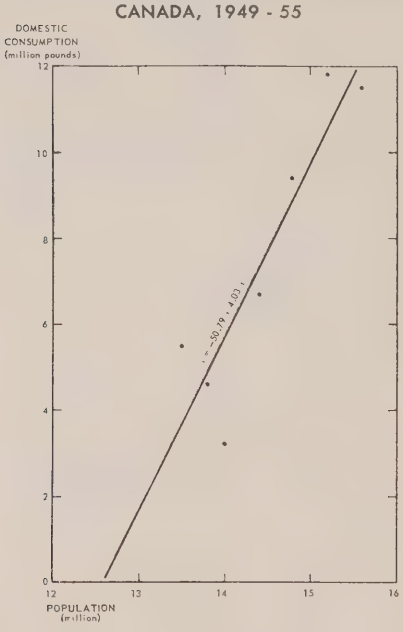


	United States Population (Million)	United States Domestic Consumption (Million Pounds)
1946	139.9	157.5
1947	143.4	163.6
1948	146.1	183.2
1949	148.7	193.9
1950	151.4	193.8
1951	154.4	238.1
1952	157.0	224.0
1953	159.6	218.5
1954	162.4	253.8
1955	164.5	243.6
1980	230.0*	503.7**

FIGURE 26

*Estimated
**Computed from Regression line

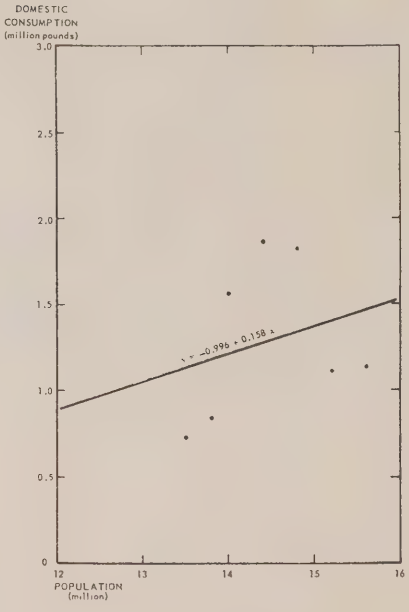
DOMESTIC CONSUMPTION OF PICKEREL (YELLOW AND BLUE), FRESH AND FROZEN, ROUND OR DRESSED, AND POPULATION, CANADA, 1949 - 55



	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	5.5
1950	13.8	4.6
1951	14.0	3.2
1952	14.4	6.7
1953	14.8	9.4
1954	15.2	11.8
1955	15.6	11.5
1980	26.6*	56.4**

FIGURE 27

DOMESTIC CONSUMPTION OF LAKE TROUT, FRESH AND FROZEN, ROUND OR DRESSED, AND POPULATION, CANADA, 1949 - 55



	CANADIAN POPULATION (million)	DOMESTIC CONSUMPTION (million pounds)
1949	13.5	0.72
1950	13.8	0.83
1951	14.0	1.56
1952	14.4	1.86
1953	14.8	1.82
1954	15.2	1.11
1955	15.6	1.14
1980	26.6*	3.21**

* ESTIMATED
** COMPUTED FROM REGRESSION LINE

FIGURE 28

SEASONAL VARIATION IN SUPPLY OF LOBSTERS IN SHELL, UNITED STATES (MONTHLY AVERAGES OF THREE YEARS, 1953 to 1955)

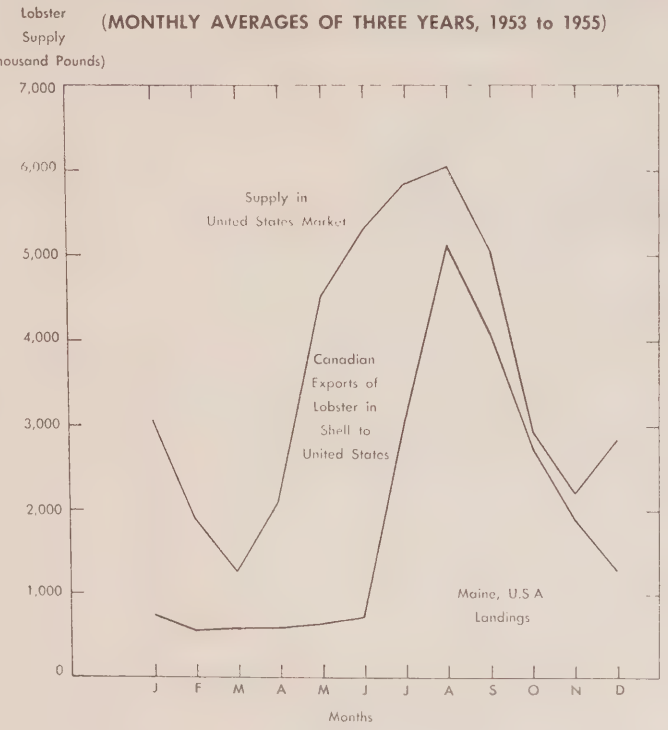


FIGURE 29

SEASONAL VARIATION IN LOBSTER PRICES RECEIVED BY FISHERMEN, MAINE AND NOVA SCOTIA, (AVERAGE OF THREE YEARS, 1953 to 1955)

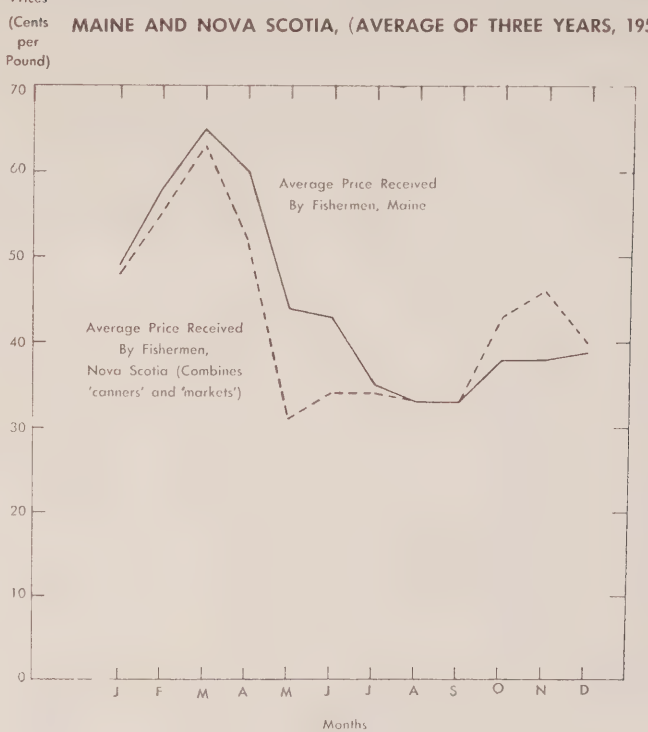


FIGURE 30

POPULATION AND CONSUMPTION OF SALTED COD (AND RELATED SPECIES)

PUERTO RICO, 1947 to 1955

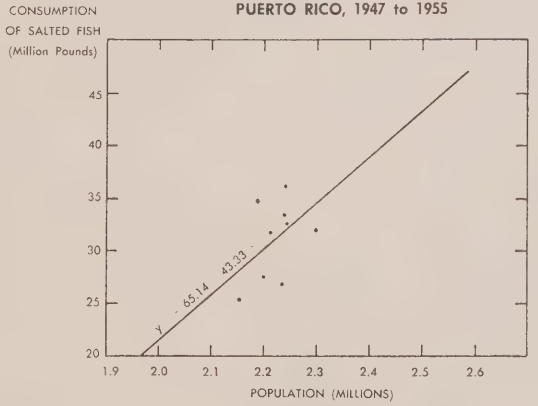


FIGURE 31

	Population (million)	Consumption (million pounds)
1947	2.2	25.3
1948	2.2	34.8
1949	2.2	27.7
1950	2.2	31.6
1951	2.2	33.4
1952	2.2	32.3
1953	2.2	26.9
1954	2.2	36.0
1955	2.3	32.0

POPULATION AND CONSUMPTION OF SALTED COD (AND RELATED SPECIES)

CUBA, SPECIFIED YEARS

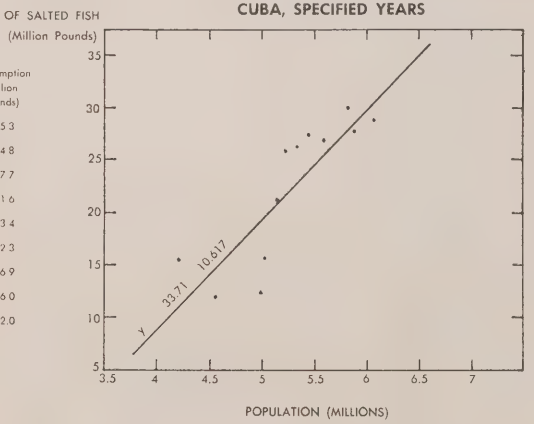


FIGURE 32

	Population (million)	Consumption (million pounds)
1935	4.2	15.5
1940	4.6	11.9
1946	5.0	12.2
1947	5.1	15.4
1948	5.2	21.5
1949	5.3	25.9
1950	5.4	26.4
1951	5.5	27.5
1952	5.6	27.0
1953	5.8	30.0
1954	5.9	27.9
1955 [p]	6.1	28.9

POPULATION AND CONSUMPTION OF SALTED COD (AND RELATED SPECIES)

JAMAICA, SPECIFIED YEARS

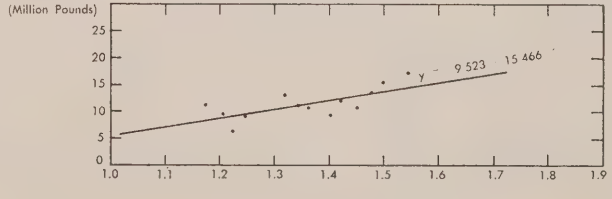


FIGURE 33

	Population (million)	Consumption (million pounds)
1940	1.2	11.5
1941	1.2	9.7
1942	1.2	6.4
1943	1.2	9.0
1947	1.3	13.0
1948	1.4	11.3
1949	1.4	11.2
1950	1.4	9.8
1951	1.4	12.1
1952	1.5	10.8
1953	1.5	13.7
1954	1.5	15.7
1955	1.6	17.3

PRODUCTION OF SUGAR AND CONSUMPTION OF SALTED COD (AND RELATED SPECIES)

CUBA, 1920 to 1955

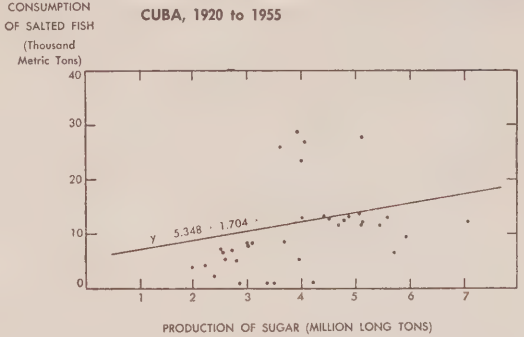


FIGURE 34

	Production of Sugar (million long tons)	Consumption of Salted Fish (thousand metric tons)		Production of Sugar (million long tons)	Consumption of Salted Fish (thousand metric tons)
1920	3.7	8.6	1938	3.0	7.9
1921	3.9	29.7	1939	2.8	7.0
1922	4.0	23.7	1940	2.8	5.4
1923	3.6	26.3	1941	2.4	2.9
1924	4.1	26.8	1942	3.4	1.4
1925	5.1	27.8	1943	2.9	1.2
1926	4.9	13.2	1944	4.2	1.3
1927	4.5	12.9	1945	3.5	1.1
1928	4.0	13.0	1946	4.0	5.5
1929	5.2	12.6	1947	5.8	7.0
1930	4.7	12.0	1948	6.0	9.8
1931	3.1	8.2	1949	5.1	11.7
1932	2.6	5.6	1950	5.5	12.0
1933	2.0	4.5	1951	5.6	13.2
1934	2.3	4.7	1952	7.1	12.2
1935	2.5	7.0	1953	5.1	13.6
1936	2.6	6.9	1954	4.8	12.6
1937	3.0	8.1	1955	4.4	13.1

PRODUCTION OF SUGAR 1950-51 TO 1954-55, AND CONSUMPTION OF SALTEDCOD (AND RELATED SPECIES)

PUERTO RICO, 1951 to 1955

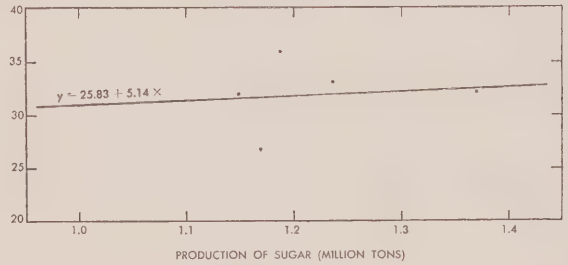


FIGURE 35

	Production of Sugar (million tons)	Consumption of Salted Fish (million pounds)		
1950-51	1.2	1951	33.4
1951-52	1.4	1952	32.3
1952-53	1.2	1953	26.9
1953-54	1.2	1954	36.0
1954-55	1.2	1955	32.0

PRODUCTION OF SUGAR AND CONSUMPTION OF SALTED COD (AND RELATED SPECIES)

JAMAICA, 1951 to 1955

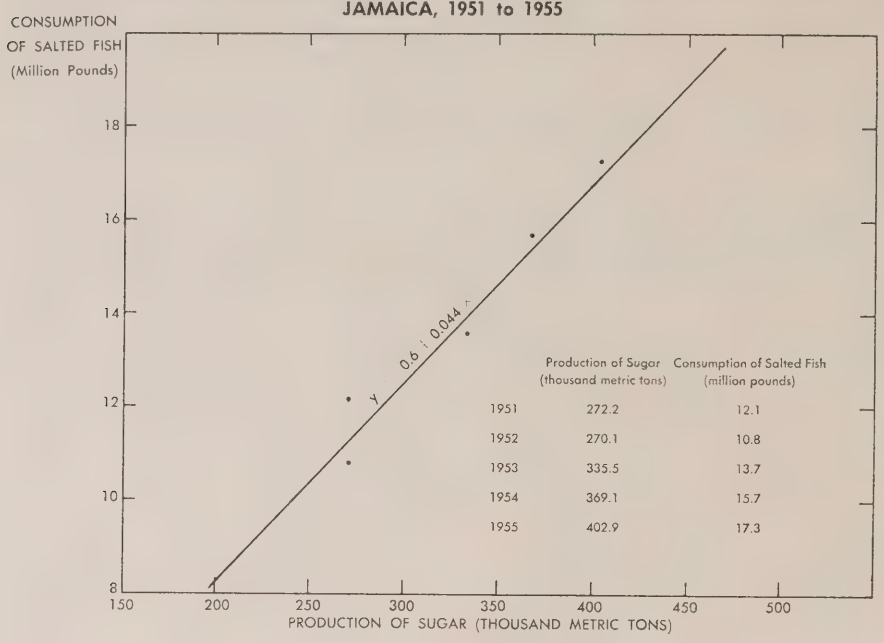


FIGURE 36

EXPORTS OF COFFEE AND CONSUMPTION OF SALTED COD (AND RELATED SPECIES)

BRAZIL, 1951 to 1955 AND AVERAGES 1935-39 AND 1945-49

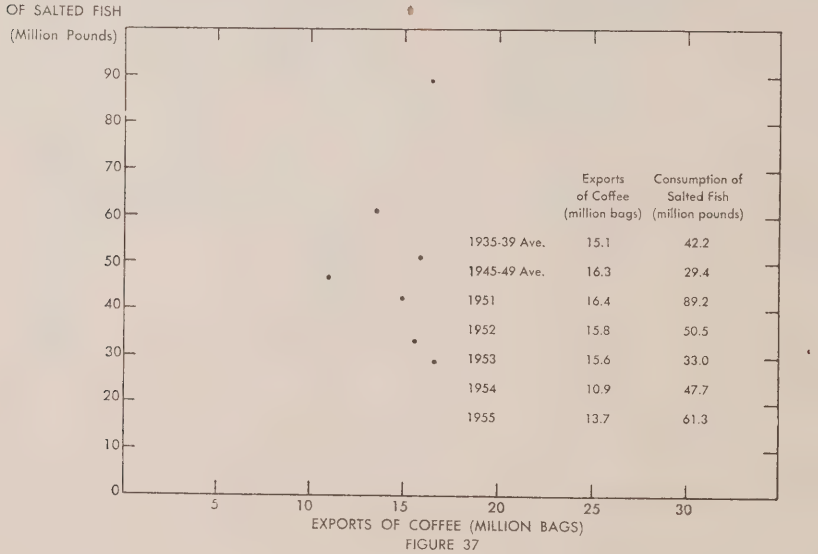


FIGURE 37

VALUE OF CAPITAL EQUIPMENT IN PRIMARY FISHERIES, CANADA EXCLUDING NEWFOUNDLAND

(VALUES IN MILLIONS OF CURRENT DOLLARS)

1940 to 1954

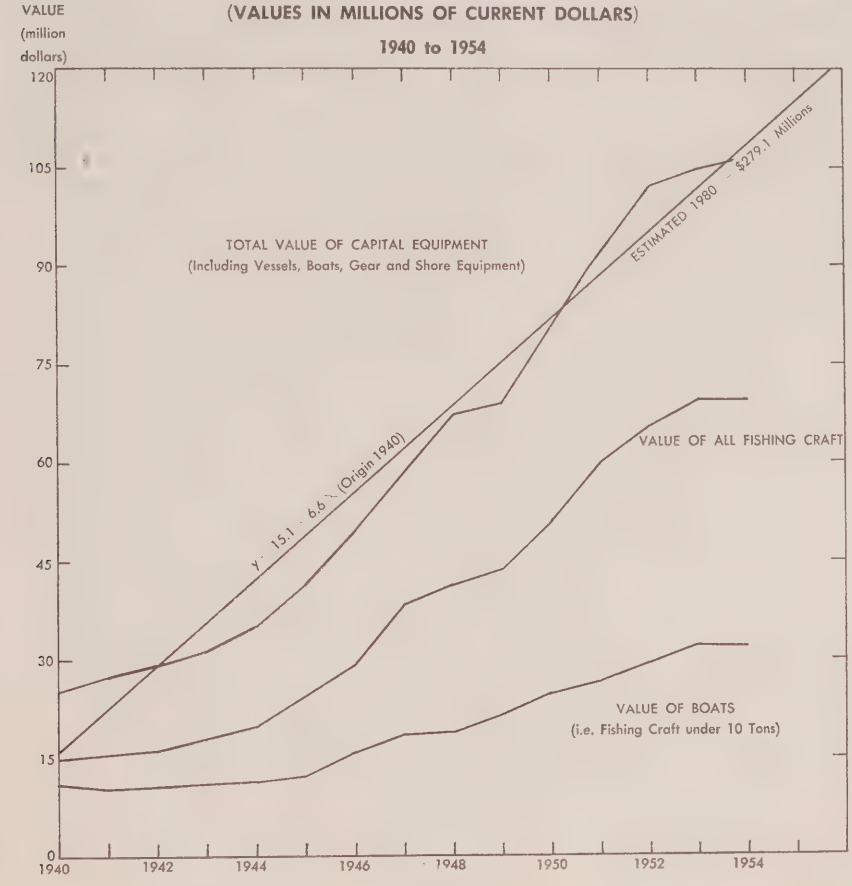


FIGURE 38

NUMBER OF FISHERMEN

NEWFOUNDLAND; CANADA, EXCLUDING NEWFOUNDLAND; AND CANADA INCLUDING NEWFOUNDLAND

1937 to 1954

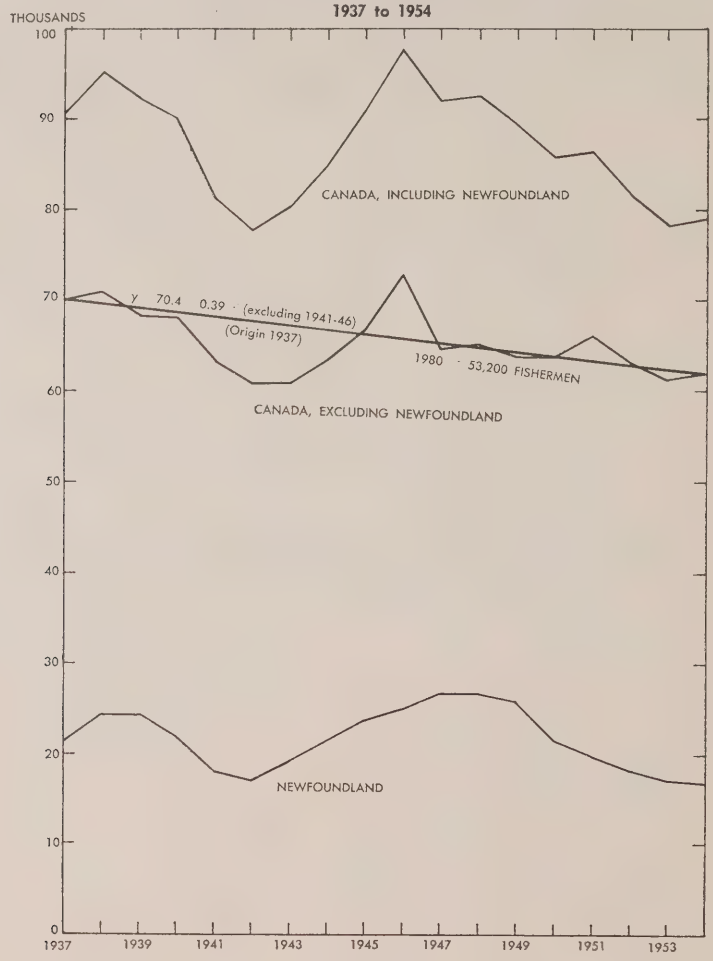


FIGURE 39

FOOTNOTES

Chapter 1

[1] This chapter is based on a longer article, prepared by one of the writers of the present report, for the *Encyclopedia Canadiana.*

[2] Innis, H. A., *The Cod Fisheries: The History of an International Economy,* rev. ed., Toronto, 1954, p. 52.

[3] It was superseded in that year by a reciprocal arrangement between Canada and the United States which in turn was discontinued in 1924. *Modus vivendi* privileges for U. S. vessels in Canadian ports, and for Canadian vessels in U. S. ports, were revived in a modified form in 1933. In 1950 the Pacific Coast Privileges Act confirmed the arrangement, making annual legislation for the purpose unnecessary.

[4] Lunenburg schooners began to fish the Grand Bank in 1873.

[5] Efficiency is relative to technical progress. Restriction on the use of traps in the Pacific salmon fisheries after 1930, on response to pressure from gill-netting interests, was an instance of the self-frustrating policy referred to. As an instrument of production, however, the trap has a serious fault: since it is stationary, its operating season tends to be short and its output unstable. In the intervening period, therefore it may have been superseded by mobile fishing craft like the purse-seiner equipped to locate and maintain contact with the fish runs.

[6] The index of wholesale prices for fishery products has been running 40 to 50 points above the index of general wholesale prices (both on a 1935-39 base), but the former index is heavily influenced by the rise in prices of canned and other salmon products which comprise over 25% of the weighting.

[7] The appearance of outlets for pre-cooked foods, including "fish sticks", is the latest manifestation of the trend.

[8] See p. 120 *et seq.*

Chapter 2

[1] The elevated or shoal areas of the continental shelf.

[2] There are several commercially significant species of marine mammals and seaweeds also.

[3] The classification is based wholly on commercial considerations and, of course, has no biological significance.

[4] The total stock of fish species is estimated by dividing the rate of utilization, i.e. the rate of removal from the population by fishing, into the catch. The rates of utilization are derived from records of the recovery of tagged or marked fish, from comparaisons of catch with escapement, e.g. in the case of anadramous species, and sometimes from information of a cruder nature. In many, perhaps most, cases the data available for this purpose are inadequate and the degree of precision achieved in the estimation of total stocks is largely dependent on the artistry of the scientific staff. For the major fisheries, at least, it is considered to be reasonably high.

[5] The halibut stocks of the Gulf of Alaska are included but not, for example, the groundfish stocks of George's Bank (off the New England coast) and the west coast of Greenland. See map, Appendix A.

[6] The tables and the accompanying text summarize a detailed compilation of the data available at present on Canada's fishery resources, prepared by Dr. W. E. Ricker with the help of colleagues on the staff of the Fisheries Research Board of Canada. Regrettably, space does not permit acknowledgment in full of the sources drawn upon.

[7] It is difficult to distinguish the effects of fishing on the size of a stock from those due to variation in environmental conditions when, as is usually the case, the direction and extent of the latter are unknown.

[8] These are the long-run or equilibrium effects of a change in the intensity of fishing. The immediate effect of increased intensity, other things being equal, is always a larger catch for the current season and the immediate effect of decreased intensity always a smaller catch. The short-term effects thus tend to obscure the ultimate result.

[9] Gordon, H. S., "An Economic Approach to the Optimum Utilization of Fishery Resources", *The Journal of the Fisheries Research Board of Canada,* Vol. 10, (7), 1953.

[10] See the discussion *infra* of the organization of the primary fishing industry and the question of management policy, p. 110.

[11] Except halibut, *q.v. infra.*

[12] Including three separate species.

[13] Negligible quantity.

[14] Including two separate species.

[15] Including four separate species, but excluding Halibut and Greenland Halibut.

[16] Including four separate species.

[17] Unknown but probably very large.

[18] Including ten out of some two dozen separate species.

[19] Including five species of major importance.

[20] Some ten or more species, including scrap fish.

[21] So called because normally found on or close to the sea bottom.

[22] Also known as Rosefish and Ocean Perch.

[23] Commonly known also as Greysole.

[24] Also called Whiting.

[25] Commonly known as Catfish.

[26] Known locally as Turbot.

[27] Including Barn-door Skate, Big Skate, Thorny Skate and Spinytailed Skate, the first three being the most important.

[28] That is, the production of meal and oil.

[29] The principal species are Lemon Sole, Brill, Rock Sole, Butter Sole and Dover Sole.

[30] With reference to Pacific dogfish, see the remarks above on the Atlantic species.

[31] Negligible quantity.

[32] The use of drag-nets is prohibited because of the contingent destruction of immature fish.

[33] This was the first international agreement contracted by Canada as an independent nation.

[34] Also known as Chinook Salmon.

[35] That is, periodically ascending streams from the sea for breeding purposes.

[36] The species are widely dispersed in the Pacific ocean, and may be the object of a pelagic, i.e. open sea, fishery in its western reaches.

[37] The use of traps is severely restricted.

[38] Resulting, evidently, from railway building operations.

[39] The potentialities for locating new sockeye stocks on the Fraser are comparatively insignificant.

[40] One should be reminded at this point, perhaps, that the causal connection in fact has not been established and that the predicted cooling is not certain to occur.

[41] The adult egg-carrying females are known as berried lobsters.

[42] Resembling somewhat the situation in the Pacific halibut fishery, lobstering operations tend to become over-capitalized except where groups of fishermen have organized voluntarily to control participation and investment in the local fishery.

[43] Unknown.

[44] Less than half unit.

[45] No change.

[46] Shucked weight approximately one-ninth of this figure.

[47] Including two separate species.

[48] Including eight separate species.

[49] Including two separate species.

[50] These figures represent numbers of animals, not weight.

[51] Irish moss only.

[52] Including three separate species.

[53] Including seven separate species.

[54] Markerel is a food fish of superior quality but its preservation presents some technological difficulties.

[55] Also known as Gasperot.

[56] The forecast does not take into account the possible incidence of epidemic disease, like that which decimated the Prince Edward Island stocks in the 1920's and now threatens those of New Brunswick. Its effects, if unchecked, could reduce the fishery to an insignificant level for ten years or longer and might inflict permanent damage.

[57] Also called the Cherrystone Clam and the Hard-shelled Clam.

[58] There are actually two species: a native one and another introduced from Japan, the latter being now the more important.

[59] Whale meat is becoming an important item of food on fur ranches, both in British Columbia and in Newfoundland.

[60] Late in 1955, negotiations for a new treaty began among Canada, Japan, the U.S. and the U.S.S.R. As this is being written, no agreement had been announced.

[61] The other fishery resources of the Arctic seas are not discussed here. Their exploration and evaluation is in an early stage. In general, the slow growth and low metabolism prevailing in Arctic waters precludes the expectation of large sustained yields from fish stocks. On the whole, these cannot be the basis of much more that subsistence fisheries for the native population.

[62] The Canadian zones, that is.

[63] Commonly known as Pickerel and Wall-eyed Pike, and including Yellow Pike-perch and Blue Pike-perch.

[64] Including Lake Herring and Tullibee.

[65] Also known as Northern Pike, Jackfish, etc.

[66] Or Lake Trout.

[67] Including Burbot, Carp, Catfish, Drum, Goldeye, Mullet, Saugers, Smelt (an anadromous species introduced to the Great Lakes), Sturgeon and others.

[68] The Convention, between Canada and the United States, was ratified in 1955. It provides for a co-ordinated research and management programme. The most urgent immediate objective is the elimination of the predator lamprey, an intruder from the sea, which has almost destroyed the trout stocks of the Great Lakes. Apart from that, there has been a long-run tendency for some of the more valuable species to decrease in abundance and to be replaced by less valuable ones. Further questions for investigation are whether the latter have actually increased in supply or are merely more heavily fished, and what share in responsibility for the shift in species should be assigned to selective fishing, to climatic change and to increased sediment and nutrients, resulting from intensified agriculture and from urban sewage.

Chapter 3

[1] Tarr, H.L.A., *Control of Bacterial Spoilage of Fish with Antibiotics,* Studies Series No. 438, Fisheries Research Board of Canada, 1955.

[2] Gibbons, N. E. and Reed, G. B., *The effect of Autolysis in Sterile Tissues on Subsequent Bacterial Decomposition,* Studies Series No. 96, Fisheries Research Board of Canada, 1930.

[3] Tarr, H.L.A., *Microbiological Deterioration of Fish, Post Mortem, Its Detection and Control,* Bacteriological Review, Vol. 18, No. 1, Fisheries Research Board of Canada,March, 1954.

[4] MacCallum, W.A., *Fish Handling and Hold Construction in Canadian North Atlantic Trawlers,* Fisheries Research Board of Canada, 1955.

[5] This is also true with reference to the newly developed use of refrigerated sea water. See *Transport and Storage of Fish in Refrigerated Seawater,* Progress Report of the Pacific Coast Stations, Part I-IV, Fisheries Research Board of Canada, 1955.

[6] Young, O.C. *Quality of Fresh and Frozen Fish and Facilities for Freezing, Storing and Transporting Fisheries Products,* Studies Series No. 309, Fisheries Research Board of Canada, 1950.

[7] Castell, C.H. and Greenough, M.E., *Spoilage of Fish in Vessels at Sea, Effect of the Removal of Gills on Rate of Spoilage,* Journal of the Fisheries Research Board of Canada, Vol. 13, (3), 1956.

[8] *Quick Frozen Foods,* Waffle Corporation of America, February, 1956.

[9] This and later descriptions of the history of fish preservation are taken from Cutting, C. L., *Fish Saving*, London, 1954.

[10] Tarr, H. L. A., *op. cit.* p. 4.

[11] Tarr, H. L. A., *Oxidative Rancidity in Frozen Fish,* Studies Series No. 424, Fisheries Research Board of Canada, reprint, 1955.

[12] Cutting, C. L., *op. cit.,* p. 12.

[13] *The Technology of Herring Utilization,* Director of Fisheries, Bergen, 1953.

[14] Page 1, *supra.*

[15] Later the operators moved their primitive machinery to a base on the Sacramento River to can Pacific salmon and the industry gradually spread northward, eventually reaching the Aleutians. Cf. p. 0, *supra.*

[16] The terms "iced", "chilled" and "fresh" are synonymous. The current usage in the trade today favours "fresh" and it is used in what follows.

[17] Tressler, D. K., and Evers, C. F., *The Freezing Preservation of Foods,* New York, 1943.

[18] Young, O. C., *Food Technology,* Vol. 4, Studies Series No. 447, Fisheries Research Board of Canada, 1950.

[19] Cutting, C. L., *op. cit.,* p. 296.
"Frozen fish have commonly been found to be in poor condition apart from any spoilage due to decomposition before freezing took place. In extreme cases a tough, spongy, tasteless mass is what remains after thawing. Investigation has shown that this condition results from slow freezing and long storage under unfavourable conditions. If frozen fish are to have the qualities of fresh fish, which are so necessary for the appreciation of the consumer, it is now generally admitted that rapid freezing is essential." The Royal Commission Investigating the Fisheries of the Maritime Provinces and the Magdalen Islands, *Report,* Ottawa, 1928, p. 68.

On the Canadian Atlantic Coast, filleting and freezing in shore plants began to be explored about 50 years ago. The same combination had been experimented with at sea but the results, from both a technical and a financial standpoint, had been disappointing. Cf. Cutting, C. L., *op. cit.,* p. 300 *et seq.*

[20] Huntsman, A. Y., *The Processing and Handling of Frozen Fish, as Exemplified by Ice Fillets,* Biological Board of Canada, Bulletin No. XX, 1931.

[21] The labelling regulations under the Meat and Canned Foods and the Fish Inspection Acts require the identification of species on packages and cans.

[22] Although there are no precise estimates of the retail value of all fishery products, it is probable that it amounts to $400 to $450 million annually, or less than 2% of the G. N. P.

[23] *Fisheries Statistics of Canada,* D. B. S., 1953.

[24] *Trade of Canada,* D.B.S., 1955, n.o.p. means "not otherwise provided for".

[25] Unpublished documentation, Department of Fisheries.

[26] Including n.o.p. groups.

Chapter 4

[1] Newfoundland Fisheries Board, *Annual Reports.*

[2] In the annual price negotiations in British Columbia, strikes and stoppages are a matter of record and some have been extensive. In Newfoundland there have been years when there were threats to "burn the boats", but general and concerted activity evidently has not been possible.

[3] There is a substantial mail order business during the cold months which provides a market coverage to rural areas adjacent to the principal market centres both in the United States and Canada. In 1953 there was a sharp break in the market for species from northern lakes and one of the reasons advanced for the break was the mild winter, which had practically stopped mail order sales.

[4] See Table VI.

[5] For several years the Department of Fisheries has provided fish prices to the C.B.C. for use in daily broadcasts to fishermen. In the absence of a market, the prices are obtained from individual buyers or sellers at important fishing ports. Canadian fishermen along the Atlantic Coast also receive reports of prices broadcast from U.S. ports. These are an important source of information about species like lobsters and swordfish.

[6] Until very recently studies of food consumption in North America were concerned with agricultural products. The inclusion of fishery items was largely a matter of whim. Earlier studies, including those conducted in the United Kingdom, were of a budgetary nature and were concerned with the food supplies of the "lower classes".

[7] Innis, H. A., *op. cit., passim.*
Cutting, C. L., *op. cit.,* p. 118 *et seq.*
The Royal Commission Investigating the Fisheries of the Maritime Provinces and the Magdalen Islands, *op. cit., passim.*

[8] The practices of individual firms vary considerably in the degree to which they oversee or, in some cases, control the distribution of their own products. Some canneries pack under chain brands (custom packing) and their identification with the product ceases with delivery

to the buyer. Other companies pack only under their own labels and maintain a large measure of control through ownership of interior stocks, brand advertising and regional sales representation.

[9] In 1952-53 the Fisheries Association of British Columbia sent representatives to the United Kingdom to explore the possibilities of linked trade, i.e. industry-encouraged trade to provide dollars for the purchase of salmon from the sale of production requisites to the British Columbia fishing industry.

[10] The Royal Commission Investigating the Fisheries of the Maritime Provinces and the Magdalen Islands, *op. cit.,* p. 40.

[11] Stated by representatives of the trade at a meeting held in Ottawa, April, 1956.

[12] Mackay, R. A., (Ed.), *Newfoundland: Economic, Diplomatic and Strategic Studies,* Toronto, 1946, p. 114.
Newfoundland Fisheries Development Committee, *Report,* St. John's, 1953, pp. 14 and 79.

[13] Legislation for the establishment of the Newfoundland Fisheries Board was passed by the Commission of Government in 1936. Among its wide powers, the Board was authorized to license exports. As export groups were set up to sell in particular markets, e.g. Portugal, Puerto Rico, Jamaica, Spain and Brazil, the Board issued licences for export to these markets solely to the particular group concerned (Dept. of Fisheries files).

[14] Under licences issued by the Newfoundland Fisheries Board.

[15] Letter from the Acting Chairman, dated Aug. 7, 1947, conveying the conditions attached to the exclusive right of export by the Commission of Government.

[16] In the important Mediterranean markets, imports were subject to varying degrees of government control.

[17] Attempts by other exporters to break into these markets, using price or commission advantages, were frequent and the management and NAFEL directors have had to expend considerable time and effort in attempts to repair the dykes.

[18] On the 1949 operation in Newfoundland, the Board had an operating loss of $82,564. Deficiency payments to fishermen (on 1950 production) were $447,539 for Labrador fish and $800,000 for shore fish. The deficiency payment on 1953 production was $646,984, and $900,000 was spent for relief purchases (for shipment to Greece and Korea) of Canadian Atlantic salted fish produced in 1953.

[19] Newfoundland shore fish is culled when purchased from fishermen, and graded prior to export into the following classes (size classes not shown): Prime Spanish, Choice Spanish, Prime Italian, Choice Italian, Madeira, Thirds, West India, Tomcods, and Bim.

[20] The question of the optimum storage period for light salted fish—the common Newfoundland type—is being studied, but there appears to be general agreement that the period could be lengthened by cool storage.

[21] The magnitude of the grade differentials is illustrated in the following data for the 1953-54 marketing season:

Average Export Prices, Dollars per Quintal (112 lb.)

Newfoundland shore fish (small), f.a.s. bulk

Grade	(Dollars)
Merchantable	18.14
Madeira	14.43
Thirds	12.84
Tomcods	13.08
West India	12.16

[22] Published data on fish processing establishments do not differentiate between the processes used, i.e. canning, salting, etc. A survey of plants producing fresh and frozen fish, carried out by the Department of Fisheries in 1954, covered 600 establishments across the country.

[23] An example of the complexity of organization is shown in the section of the *Canadian Fisheries Annual,* published by National Business Publications Limited, Gardenvale, P.Q., which provides a partial directory of fish processing firms and an indication of their products.

[24] In 1954 the sales value of factory shipments of 586 fish processing establishments was $153.4 million. About 7% of the establishments sold 65% of this total. See Table VI.

[25] The value of sales by fishermen in any year is about equally divided between these three types of market. The estimated landed value of fish bought at negotiated prices in 1955 was about $29 million, at leadership prices $29 million and at market prices $33 million.

[26] For details of typical lay arrangements see J. Proskie et al., *Analysis of the Fishing Operations of 99 Long-Liners and Draggers in the Atlantic Provinces — 1954,* Department of Fisheries, Ottawa, 1955.

[27] Utilization of cod landings, Maritimes and Quebec, 1955.

Form	%
Fresh, dressed	1.9
Fresh, filleted	4.5
Frozen, dressed	0.3
Frozen, filleted	29.3
Smoked, filleted	2.0
Salted	61.7
Other	0.3
Total	100.0

[28] See Appendix C.

[29] To some extent the continued use of the smallest practical measure of weight may be explained by the large amount of manual labour that was, and still is in some areas, associated with fishing. When nets or lines were lifted manually, when boats were rowed to and from the grounds and when the catch was pronged to the wharf one fish at a time, the weight that could be handled by one man was so small that the pound was a logical unit of measurement. In the sardine industry of New Brunswick, however, the fish caught are so small that they are seined and brailed by the thousand and the traditional unit is the hogshead, which is supposed to be 1,000 lb. but generally is the quantity of fish that can be put into a seine-boat without sinking it.

[30] Tarr, H.L.A., *Control of Bacterial Spoilage of Fish with Antibiotics*, Studies Series No. 438, Fisheries Research Board of Canada, 1955.

[31] Prices at plant are obtained by dividing the marketed value of any product by the quantity marketed during the year. Annual figures of this kind do not, of course, reveal the important changes that may take place during the year and, by definition, include inventories at the end of the year which are valued largely at the whim of the plant operator and which may subsequently be sold at a different price.

The principal use of marketed-value data is the measurement of the value added by the processing industry. For several important items the concept is related to the facts—for example in canned, frozen and smoked products. For these there is a definite, and substantial, value added to the raw fish by the plant process. It has already been noted, however, that several important commodities are processed by fishermen working alone or in small groups, and the manufacturing or industry concept does not apply in such cases. This situation is largely confined to the Atlantic Coast and involves such commodities as "shore" cod, pickled herring and mackerel and bloaters. In the case of fresh fish, there is a minimum value added at the first stage of distribution. Fish received from producers are generally sized, boxed and iced, but the main costs are largely those resulting from assembly and selling—as opposed to manufacturing. Fresh fish is produced, to some extent, in all the provinces and is the characteristic form involved in the distribution of freshwater species.

The calculation of the marketed value of the entire fishing industry, therefore, involves a rather complicated statistical manipulation based upon a detailed knowledge of the methods used in the variety of individual industries. At the same time, it represents a compromise in definition because of the inclusion of products or services which would not ordinarily be associated with industry or manufacturing.

[32] These data are published monthly in the *Trade of Canada* reports and are based upon exporters' statements showing the number of packages in the shipment, the net weight of contents and the value (or selling price) f.o.b. plant. One of the major statistical difficulties in this field relates to the data for case goods. The official figures are reported in hundredweights in order to provide a common denominator for the summing of quantities. Production figures, on the other hand, are compiled in case units. To arrive at export prices per case, therefore, it is necessary to convert hundredweights to cases for division into the value figures. This could be done reasonably accurately, by accepted conversion factors, if the data furnished on the export form were consistently net weights. Unfortunately, this is not so and gross weight, including tare, is commonly reported. In some instances, the difference between gross and net weights is 25% of the lower figure. The result of this on derived prices is obvious. This situation also has important implications for the calculation of domestic consumption.

[33] These series are found in the *Monthly Review of Canadian Fishery Statistics,* D. B. S., Ottawa.

[34] Newfoundland Fisheries Development Committee, *op. cit.,* p. 11.

[35] Van Vliet, W.W., *Preliminary Survey of the Inland Fisheries of the Prairie Provinces,* Ottawa, 1948.

[36] Campbell, B.A., and Buchanan, D.R., *Economic Survey of Salmon Fishermen in British Columbia: Interim Report,* Ottawa, 1953.

[37] Proskie, J., *op. cit.*
Buchanan, D.R., *Progress Report on the Economic Survey of Salmon Fishermen in British Columbia, 1953 and 1954,* Ottawa, 1956.

[38] Data in these series are only available for the Newfoundland fisheries from 1953, and the abbreviation "M & Q" refers to data for Nova Scotia, New Brunswick, Prince Edward Island and Quebec.

[39] Based upon average prices to fishermen, 1949-55.

[40] In general, this trend towards exploitation of the northern lakes affects all the freshwater species to some degree.

[41] For Atlantic species, the averages include 1953, 1954 and 1955 only, to allow inclusion of Newfoundland data which is not available prior to 1953. For inland species the averages are for the years 1949 to 1954, and for Pacific species 1949 to 1955.

[42] There are minor species, e.g. sturgeon, B.C. crabs, Atlantic halibut, scallops and oysters which are caught from limited stocks. Conservation measures may, or may not be in effect, but the value level and price appreciation relations apply.

[43] In the Maritime Provinces and Quebec, cod landings were down considerably in subsequent years from 1950 levels. Special efforts were made to catch haddock and flatfish (plaice, witch and yellowtail or dab). The comparative figures on landings are:

Species	Landings (in mill. lb.)				
	1950	1952	1953	1954	1955
Cod	250.0	238.6	189.3	197.9	196.3
Haddock	47.3	54.9	58.5	75.2	82.2
Flatfish	16.0	42.8	46.5	39.7	64.0

[44] Wholesalers and brokers put it more simply. There is one trade for salmon and a different one for frozen groundfish. The price of one has nothing to do with the other. A member of the trade, who probably has never heard of Veblen, stated in this connection that some of his special accounts buy salmon at the price mentioned because they like to buy expensive food.

[45] More detailed analysis of demand factors is contained in a later section which deals with the projection of domestic and export requirements.

[46] Trends in the general price index and disposable income in Canada and the United States are quite similar from 1935 to 1955, and the statement above can be applied to both countries insofar as the domestic production and exports of Canadian fishery products are concerned.

[47] Not including Newfoundland production.

[48] For comment on the significance of the labour provided by fishermen in processing, see p. 000.

[49] 1954 prices.

[50] Information on the marketed values of some important commodities is not available for 1955.

[51] The comparison between the prices of cod and its products is weakened by the movement of salted cod in the wet state from Newfoundland to Nova Scotia for finishing in mechanical dryers. The saltbulk price embodies costs for fishermen's labour in heading, splitting, salting and piling operations, in addition to some overhead and supply costs borne by fishermen. In Newfoundland these costs are included in the raw material value of the fish, and the comparability of prices at primary and secondary levels is thus lessened.

[52] That is, salted cod produced from catches inshore, as contrasted with that formerly produced by the bank fishery.

Chapter 5

[1] "As recently as 1950, the average supermarket carried 1,500 brands; today the average is 4,000 and some of the larger stores carry as many as 5,000. In 1954 the Scripps-Howard newspaper chain found some

12,039 grocery brands in 15 different cities. There were, for example, 41 brands of packaged dry baby cereals. There were 94 brands of other cold cereals." *Consumer Reports,* May, 1956. p. 255.

[2] See Table I, Appendix B.

[3] There are offsetting trends within the overriding one, e.g. the effect of Engel's law may be offset by a change in the age or sex ratio, or a trend away from low-priced carbohydrate foods may be offset by a trend to higher priced foods bought in smaller quantities.

[4] "Fish have been called 'The bottom rung of the economic ladder of meat'." White, D. J., *The New England Fishing Industry,* Harvard University Press, 1954, p. 114.

[5] Special consideration is given to the demand for salted groundfish, which is not sold in substantial quantities in North America, in a later section.

[6] *Cf.* Daly, R. F., *The Long-Run Demand for Farm Products,* Agricultural Economics Research, U.S. Dept. of A., July 1956, p. 86.
See Charts 12 and 13 for examples of the relation between exports and U.S. population.

[7] From whole fish only, i.e. herring.

[8] See p. 94 *et seq.*

[9] Lobster canning in New England amounts to only a few thousand cases annually.

[10] In comparison with the tariff on salmon in cans, the rate on dressed salmon is 1½¢ per pound.

[11] The smoked products sold in North America have to be distributed under refrigerated conditions.

[12] Crustaceans and molluscs.

[13] The United States also imports several million pounds annually, mainly from Japan.

[14] To a considerable extent the substitution may take place through ignorance of the differentiation that exists. Fillets may well be fillets irrespective of species, and the salmons may be no more than pink fleshed fish which always seem quite expensive.

[15] *Cf.* Van Vliet, W. W., *op. cit.,* p. 25 - 27.

[16] For example, the U.S. Tarif groups these species in item 717b, and investigations before the U.S. Tariff Commission are referred to as Hearings on Groundfish Fillets, although flatfish fillets are not included.

[17] References to some aspects of the transportation factor in the marketing of fishery products are found in, e.g. Newfoundland Fisheries Development Committee, *op. cit.,* p. 83 *et seq*; Gordon, H. S., *The*

Fishing Industry of Prince Edward Island, Ottawa, 1952, p. 44; *Trade News,* Department of Fisheries, October, 1949, p. 27 *et seq.*

[18] Union with Newfoundland in 1949 added appreciably to Canadian exports.

[19] The quota is calculated annually on the basis of consumption in the the United States over the previous three years and is administered on a quarterly breakdown of the annual total.

[20] Flatfish are not included in U.S. statistics of fillet consumption, so the species involved in this particular calculation include cod, haddock, hake, pollock, cusk, redfish and wolffish. The contribution of fillets of flatfish to Canadian exports of the total groundfish group is relatively minor, and the fact that they are not included in the U.S. consumption figures in this connection is not significant for the purpose here.

[21] See, for example: *Consumer Preferences for Breaded Shrimp and Fish Sticks,* 1954, U.S. Fish and Wildlife Service, Fishery Leaflet 422, 1955, p. 13: "The number of homes serving fish and shellfish as main meals at least once a month ranges from about 70% to 85% (of the homes sampled). This percentage is lowest in the south and highest in the North Eastern States." A similar situation is described for the Canadian population in the data gathered by the D.B.S. in connection with surveys of food purchases by urban families. Unpublished material collected by the Bureau suggests that, in some major cities, purchases of fresh and frozen fishery products is restricted, habitually, to 50% or 60% of the population in these cities.

[22] The U.S. tariff, 20% *ad valorem* on uncooked and 30% on cooked fish sticks, rules out competition from Canadian processors.

[23] See p. 85, *supra.*

[24] It is interesting to speculate about the extent to which business expense accounts finance expensive restaurant meals, including lobster dinners. If this type of expense were not deductible for tax purposes, the demand for lobster in North America might sag appreciably.

[25] *Cf.* Gordon, H. S., *op. cit.,* p. 10.

[26] In Nova Scotia the de-boning process has been transferred largely from plants to homes in an attempt to bring costs into line with returns from the markets. Women and girls remove the bones from the wet salted fish that is delivered to them by truck but the lower costs that result from the use of this particular type of labour cannot be relied upon in considering production levels of the future.

[27] The effects of Civil War created an abnormal situation in Spain in 1939.

[28] Imports plus production, or imports only, are assumed to represent total consumption. No adjustment has been made for year-end stocks, as these data are unavailable for most countries.

[29] *Cf.* McCarthy, J. P. and Tausz, J., *Salt Fish Industry in Hong Kong,* The Government Printer, Hong Kong, p. 11. "Though some (salted fish) are made into fish paste, yet others are cooked as they are and taken with the daily rice as a condiment."

[30] Gerhardsen, G. M., *Salted Cod and Related Species,* F.A.O. Fisheries

[31] Unpublished documentation, Department of Fisheries.

[32] (a) "In 1937, the Santa Cruz Oil Company of San Francisco made an agreement with the Commission of Government to establish two plants for the manufacture of herring meal and herring oil in Newfoundland, a permanent plant at Argentia and a floating plant to operate on the Labrador. The Government subsidized the scheme to the extent of $225,000 and gave it monopoly rights for twelve years in Placentia and Fortune Bays and fifteen years on the Labrador coast. After a short operating period they were closed as herring were not to be had in sufficient quantities." MacKay, R. A., (ed.), *op. cit.,* p. 87.
(b) In 1953, according to press reports, Mercury Fisheries Ltd. obtained a large loan from the Nova Scotia government to establish a new herring processing industry on the Atlantic Coast. This venture also failed and among the reasons advanced was the difficulty in obtaining a dependable supply of raw material.

Chapter 6

[1] The discussion of technology here and in other parts of the study has benefited from information provided in a special report prepared for this purpose by Dr. N. M. Carter, with the assistance of other members of the Fisheries Research Board staff.

[2] The problems of optimal allocation of resources in the fishing industry have been discussed by Gordon, H. S., "The Economic Theory of a Common-Property Resource: the Fishery," *The Journal of Political Economy,* Vol. LXII, No. 2, pp. 124 - 142, and Scott, A., "The Fishery: the Objectives of Sole Ownership," *ibid.,* Vol. LXIII, No. 2, pp. 116 - 124.

[3] Common techniques for control of fishing in inland and territorial waters include, among others, licensing, quotas on total or individual catches, and limitation of fishing in certain seasons or areas. Precise control over time with any one or a combination of such methods is often difficult. In waters beyond Canada's three-mile limit, the fish resources may, subject to the international limitations noted, be freely exploited by fishermen of all nations, except that, in the case of

draggers of Canadian registry over 65 feet in length, there is a prohibition against fishing within 12 miles of the coast of all Atlantic provinces except Newfoundland.

[4] These averages should be considered merely as approximations of the capitalization per enterprise in each region.

[5] The calculations are taken from Proskie, J., *Production Studies,* Vol. 5, Part 1 (1955), Markets and Economics Service, Department of Fisheries, Ottawa, 1956.

[6] Row and sail boats not included.

[7] These calculations are based on data gathered in field surveys in 1953 and 1954. See Buchanan, D. R., and Campbell, B. A., *An Economic Survey of Salmon Fishermen in British Columbia, 1953 and 1954,* manuscript report soon to be published by the Markets and Economics Service, Department of Fisheries, Ottawa.

[8] Statistics are not precise because data on freshwater fish processing are still rather meagre.

[9] See p. 80, *infra.*

[10] All sums in current dollars.

[11] The Fisheries Association of British Columbia, *Submission to the Royal Commission on Canada's Economic Prospects,* Vancouver, November, 1955.

[12] In personal interviews with officials of the Department of Fisheries.

[13] See footnote p. 128.

[14] Applicable also to lobster traps.

[15] In the main, the most urgent requirements are those of the curing (salting and drying) branch of the industry on the Atlantic Coast, although there is considerable scope for improvement in the efficiency of filleting operations, for example, on the Pacific Coast and in the inland area also. The release of the Newfoundland cod fishermen from the serious limitations of shore curing appears to depend upon the extent to which this operation can be centralized in large-scale drying plants.

[16] It is also controlled in some areas by the peculiar spawning habits of the various species and in some cases by conservation regulations.

[17] Buchanan, D. R., and Campbell, B. A., *op. cit.*

[18] Proskie, J., *op. cit.*

[19] The size classification is based on the over-all length in feet, e.g. the 50-60 ft. size class includes craft measuring 50 ft. and over but less than 60 ft.

[20] The leader in the fishing expedition, ordinarily the master or captain of a fishing vessel.

[21] That is, a fishing captain or master of a fishing crew.

[22] Newfoundland Fisheries Development Committee, *op. cit.,* p. 20.

[23] The figure is a weighted average, based on a survey of 256 salmon fishermen in 1954. See Buchanan, D. R., and Campbell, B. A., *op. cit.*

[24] *House of Commons Debates: Budget Papers,* March 20, 1956, p. 27.

[25] On the basis of estimates by fishery officers, which would include all fishermen and certainly involve some double counting because of more than one licence being issued to the same fisherman, this would place the 1980 estimate at about 53,000 fishermen for Canada, excluding Newfoundland. On the basis of the 1951 census sample which included only those who had spent 15 or more days fishing or had earned $100 or more from fishing in the previous year, the estimate for 1980 would be about 23,000 fishermen. The future, i.e. 1980, level of employment no doubt lies somewhere between these two figures, probably in the vicinity of 35 to 40 thousand fishermen.

[26] Salt fish curing by fishermen is, however, not included in the count of processing establishments or of employment in fish processing.

[27] Employment statistics for later years are not comparable with those for 1952 and previous years.

[28] As noted above, under most circumstances in the past fish processing has been a raw material oriented industry because of the bulk and perishability of the raw product. Recent developments, however, have tended to favour a greater concentration of the industry in particular centres. Perhaps the most important of these are the developments in high-speed transport combined with improved methods of preventing deterioration *en route*. Recent research in the use of aureomycin, refrigerated sea water, etc., for the prevention of quality deterioriation indicates that greater improvements are probable in the future. Added to these are the economies of substituting capital for labour by utilizing high-speed precision equipment for such purposes as canning—which requires, in addition to a large investment, a large concentration of raw material to utilize the capital effectively. With these advantages of concentration may be combined the economies of proximity to markets, to market and financing services, and to services for processing equipment.

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[1] This is one of a series of three studies on Canadian international economic relations prepared under the direction of S. S. Reisman.

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